1.10 More Responsive Scientific and Technical Information Programs for the Federal Agencies

Stung by congressional criticisms about the inadequacy of their scientific and technical information programs and the attention being paid to these criticisms by the Executive Office of the President, the Federal agencies took heed. During the late 1950s and the 1960s there was an unparalleled period of growth of information facilities, personnel, databases that accompanied the increase of Federal laboratories, R&D personnel, R&D managers, and funding for R&D. During that period, there probably was more attention given to scientific and technical information managers than to information programs in support of Federal R&D. Each of the major Federal R&D agencies found it necessary to devote more attention, more funding, and more accounting for their STI programs than previously.

For the first time, each of these agencies selected and supported an STI focal point. The larger agencies designated staffs to support the STI focal point. Growth was very apparent in the Department of Defense. This Department has recognized the importance of information from the inception of the military services. The training of military professionals stresses the key role that information plays in every phase of planning and operations. Moreover, there is an accent on organization of detail and exercise of discipline in the gathering, analyzing, and employment of information and data that is hardly equalled in other professional fields. Scientists and engineers are taught in their undergraduate and graduate days how important information is in their work and are advised to have a reverential attitude towards the wise use of knowledge. The combination of military professionals and scientists - engineers in the Department of Defense tends to magnify their interests in scientific and technical information. The components of the Department of Defense - Army, Navy and Air Force - have been in business for generations, especially the Army and the Navy. This explains why much of the early impetus for improved programs in the Federal R&D agencies, programs that sought to develop modern, computerized STI techniques, received early attention in the Department of Defense. Walter Carlson, a highly competent engineer from Dupont and Company, was brought in to the Office of the Director for Defense Research and Engineering (ODDRE) to head up the first office. The hard-working, diligent Carlson,

headed an office of four or five specialists, including Dr. Robert B. Stegmeier, who was to become the Administrator, Defense Documentation Center, a few years later. As a staff officer in ODDR&E, Stegmaier had much to do with the establishment of the Armed Services Technical Information Center (ASTIA) in 1951. The Defense Documentation Center, became the Defense Technical Information Center around 1981. The historically-minded will note that the Department of Defense was in the dissemination business for more than a decade before the Committee on Science Information (COSI) was formed by the Federal Council for Science and Technology. Carlson presided over an advisory panel made up of the STI focal points of the three military services and other observers from the Department of Defense family. One of the most vigorous efforts in the Department of Defense was undertaken by the Office of Research and Development of the Department of the Army, which operated under the Director of the Army Research Office. The program went through a creative period in the late 1950s and early 1960s. The writer of this book was then the Director of Army Scientific and Technical Information, who enjoyed considerable support from his superiors in the Pentagon. In those few years, a large scale study was undertaken by the scientific and information experts of the Army's R&D establishment, aided by the work of several contractors. The recommendations of the study brought the support of the Army R&D leaders into play and much of the program that covered a wide spectrum of STI activities was implemented in whole or part. The size and scope of this early program is described in a 1963 article in the Army R&D Newsletter: [1]

> "An aggressive, intensively considered approach to a massively difficult problem is presented in a proposed Department of the Army Scientific and Technical Information Program required by a Defense Department instruction. Asst. Sec. of the Army (R&D) Dr. Finn J.Larsen approved the program late in January. It was then submitted to Dr. Harold Brown, Director, Defense Research and Engineering, for integration,along with proposals from other agencies, into the DoD program. The Army STINFO Program is based on findings and recommendations of 23 task study groups assigned by an Army Ad Hoc Group on STI, established in April 1962 by the Chief of Army R&D, Lt.Gen. Dwight Beach. More than 50 well recognized scientists, managers and technical information leaders discussed the program at a recent orientation meeting.

The Army STINFO program was approved intact with a massive study report. The approved office structure called for a staff of 18 persons. The meticulous planning that went into the pro-

Author unlisted, Army Develops Braod Program Aimed at Improving Untilization of Scientific, Technical Information, Army R&D Monthly Newsmagazine, Office of Chief of R&D, Hq, Department of the Army, Washington, D.C., Vol 4,No.2, Feb. 1963, p.1. (Author is thought to be Clare Smith, now deceased.)

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gram was unique in this new and growing field. The study received considerable attention from the other military services and Defense agencies as a blueprint for all R&D agencies desirous of building a strong STI program.

The programs of the Navy and the Air Force were not as enterprising as the Army's, but there was considerable strengthening of their STI programs. The Air Force created the counterpart of a STI corps, designating the effort as the STINFO officers program. When it was implemented, there were about 100 officers so designated, scattered through the various Air Force laboratories and commands. This group still meeets annually. The Navy established a small office, and like its sister services, prepared a series of directives and instructions that conformed to the basic directive prepared by Carlson in ODDRE. More will be written about the manner in which the Department of Defense sought to organize its technical information programs in the early 1960s, an effort that embraced STI and data programs in logistics, standardization, quality control, cataloging, and in specifications and drawings. It was a unique endeavor, the first and last of its kind.

If mission accomplishment is the major characteristic of a successful information program, the Department of Agriculture has to be given high grades over the years. From the outset, USDA sensed the need for a superior information program that would be based on the gathering of the world's STI, creating new agricultural knowledge through R&D, and then painstakingly making that knowledge available to individual farmers directly and indirectly through an extension service, through publications, and through symposia and other devices. Although land grant universities have played a key role in educating future farmers, it was the personal touch, carrying vital information to the farmer in his field, that exemplified the approach taken by USDA. The shrinkage of the farming population in the last few decades, a shrinkage that was accompanied by ever-increasing productivity, underscores the success of this community in making the United States the granary of the world. The information program of USDA has been developed to aid the farmer and the consumer. Like all of the STI endeavors of the Federal government, the USDA STI program has not been given sufficient credit for its accomplishments. In recent years, it has had difficulty in obtaining funds, a problem which it shares with the other Federal STI managers.

One of the very aggressive STI programs was fashioned by the Atomic Energy Commission during the 1960s when "atoms for peace" received great attention from U.S. and world leaders. During its early days, Melvin S. Day, the manager of the program, succeeded in making it into a world class system, working closely with international organizations and professional societies. When Day departed AEC to join NASA, the program was managed by Edward J. Brunenkant, who extended the work of his predecessor. It was one of the first programs to create a modern data base and a world wide network to carry it to the four corners of the earth. Like the STI program of USDA, it was a mission-serving program that sought to bring the gift of knowledge to the citizens of the United States and other countries. It succeeded admirably. AEC was enfolded into the Department of Energy in recent years. The Department of Energy has had its ups and downs, especially in the current Administration, which marked the agency for extinction, its function to be absorbed by the Department of Commerce or some other Federal entity. Congress refused to terminate the agency, so it still exists in a weakened condition. The information program is under the responsibility of the manager of the department's Technical Information Center (TIC), Joseph Coyne, who also doubles as the Department of Energy's STI program. Under his able leadership, the Department of Energy has been able to maintain its momentum while passing through troubled waters. Fortunately, the STI program is highly regarded by Congress and in the Executive Office of the President, thus it has been able to survive, although funds and personnel retention continue to be problems.

Fortunately, the rise of the National Aeronautics and Space Agency (NASA) came about during the period of the ascendency of American science and technology after World War II and the period during which Federal STI received considerable attention. The architect of the program was Melvin S. Day, already mentioned as a founder of the AEC STI program a few years earlier. Within a short period of time, Day fashioned the NASA STI program into one of the most highly regarded systems in the world. He worked closely with professional societies and commercial contractors in building the program. During its early period,

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he recognized the importance of technology transfer, the further exploitation of the knowledge created by the NASA R&D program. He worked hard with Dr. Richard Lesher, his immediate supervisor, to stimulate the flow of NASA STI to promote technology utilization within and outside of the Federal government. Lesher is the Executive Director of the National Chamber of Commerce at the time this book is being written. Day has retired from the Federal government and is now in the private sector, using the knowledge and experience he obtained in his many years of Federal service. The Director of the NASA STI Program is Van A. Wente who continues to carry on the NASA program in the tradition built by Day and his successors. The NASA data base is in great demand in the United States and abroad. To demonstrate that there is diversity in the way the Federal agencies have organized their STI programs, NASA elected to have its dissemination center operated by a contractor. It turned out to be a successful approach. Like the other Federal R&D agencies, NASA has reduced funds and spaces in its headquarters STI program. but it has managed to survive.

During the late 1950s and early 1960s, other organizations in the Executive and Legislative Branches appeared. One of these was the Smithsonian Science Information Exchange, whose function it was to gather information about ongoing R&D being undertaken by the Federal R&D agencies. This organization was originally financed by the Federal agencies and NSF during its early years. Later it was financed directly by Congress appropriations. Recently, the SSIE center was terminated and its functions transferred to NTIS, unfortunately without transfer of funds and personnel. Another organization that appeared on the scene was the National Referral Center for Science and Technology, which was operated by the Library of Congress. NRC performed a valuable service during the eary years in providing users with information about the R&D programs and facilities of the Federal government. As long as this program was funded by the National Science Foundation, it was a vigorous operation, but when NSF withdrew its funding, it became less able to carry on as it had in the past. The Center is still in operation,but its services have been greatly

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Another government-wide program was created during this period to make public distribution of technical reports generated by Federal R&D. The organization, which is in the Department of Commerce, is now called the National Technical Information Service. It is located in Springfield, Virginia, and is directed by Dr. Joseph Caponio, who has had considerable experience in other Federal STI programs before joining NTIS. In the early 1960s, NTIS received funding support from other Federal agencies, which augmented its appropriated funds. Currently, NTIS operates without appropriated funds and derives most of its revenue from the sales of the materials it receives from the Federal R&D agencies. In recent years, NTIS has been reorganized to gather more STI materials from abroad. It has also gotten into software exchange and other information services. In 1982, it was rumored that NTIS would be turned over to the private information sector by the Department of Commerce. At least for the time being, the probability of this happening has diminished. Since NTIS acts as an agent to the other Federal agencies in making their STI available, there is some question within the patron agencies about the wisdom of such a move and the willingness of the R&D agencies to go along with it. More recently, there has been discussion about combining NTIS with the Government Printing Office/Superintendant of Documents, another sales source for government STI documents. Since there is some question about separation of powers involved, it is doubtful if the Federal agencies will agree with such a move. In the meantime, NTIS tries hard to accomplish its mission remaining sensitive to the swirling political currents around it.

It will be remembered that the Weinberg (PSAC) Report (1963) urged the formation of specialized information centers. These were hybrid organizations that brought together in one locality subject-matter specialists, usually scientists, and information experts, whose major task it was to screen the literature and other information sources and make critical information and data available on demand to scientists, engineers, R&D managers, and others. During the early 1960s, there were upwards of 115 information analysis centers supported by the Federal government in the public and private sectors. The Committee on Scientific and Technical Information (COSATI) had formed

Panel #6, Information Analysis and Data Centers,in recognition of the importance of the function carried out by the centers. Dr. Donald F. Hornig, Special Assistant to the President for Science and Technology, said about the centers: [1]

> Although the concept of a "information analysis center" is new, the functions performed by such a center are very old indeed. The functions are as old as science and technology themselves; they are an integral part of the processes by which science and technology have progressed...There are several reasons why such activities need to be formally recognized now, although this was not necessary in the past. There is no need for me to quote to this group the statistics on the growth of journals and the numbers of papers, you all know them at least as well as I do. As a scientist, I find it somewhat embarrasssing and shocking to confess that the average scientist simply can't afford the time to read all of the relevant literature published in his field. Iy is even more embarrassing to have to confess that the average scientist or engineer is not even aware of the existence of much of the material relevant to what he is working on. Increasingly, I believe he must learn to rely on the activities of a group of fellow scientists, working with specialists in the processing of information, for guidance in his own work.

It is estimated that about half of these centers or their successors exist today. Despite their important function, it is doubtful that such centers could be easily established today. The interest taken in them by the science leaders in the 1960s has virtually disappeared. Sadly, there is a suspicion that the OSTP leaders are not aware of the existence of the Federally supported information analysis centers.

The Chairman of Panel 6, Information Analysis and Data Centers, who was also the chairman of the Forum, was Dr. Edward L. Brady, National Bureau of Standards. It was Dr. Brady who engineered the creation of the National Standard Reference Data System, a program that operated in the Federal government under the leadership of Dr. Brady and the National Bureau of Standards. The purpose of this program was to create a numberical values data base in the "hard" sciences, a data base of great value to scientists and engineers. The program was considered so valuable at the time of its creation that Congress agreed to allow the program to copyright the materials that it brought into the program as something akin to a Good Housekeeping

[1] Hornig, Donald F., Role and Importance of Information Analysis Centers, Proceedings of the Forum of Federally Supported Information Analysis Centers, Nov 7-8, 1967, Sponsored by Panel #6, Information Analysis and Data Centers, Committee on Scientific and Technical Information, Federal Council for Science and Technology, Washington, D.C., page 10

Seal of Approval. The program grew into an international program, called CODATA. It is now directed by Dr. David R. Lide, who is carrying on in the tradition set by Dr. Brady, whose pioneering work in this field,deserves the applause of his fellow scientists.

Recognition should also be given to the National Library of Medicine for its response to the need for improved Federal and national STI systems. Blessed with a creative leader, Dr. Martin M. Cummings, this organization has fashioned the world's most outstanding, computerized health information system. There can be no doubt but that this program has had a considerable effect on the health of American and other citizens throughout the world. NLM and its sibling, the Lister Hill National Center for Biomedical Communications, are examples of how effectively modern communications and information technology and techniques can be used to further the health of people in and out of this country. Through its efforts a world health information pool has been created. Each country is expected to contribute information about its health research programs and projects into the "pool" and have drawing rights on the contents of the pool through the vast system that NLM helped create in the United States and countries throughout the world. NLM has created a number of databases in specialized areas, including toxicology, and works hard to keep these up to date. In effect, what NLM is doing is a contribution by the United States to the health of the world. In recent months, NLM has been required to "sell" its information to defray some of the costs of its preparation and dissemination. NLM has sought to keep the charges low enough so that the information will flow as freely as possible. It is a sad commentary that its program and policy has been attacked by organizations in the private sector, which want NLM to further raise its prices to enable them to make more profits. Ironically, the National Institutes of Health, the parent organization of the NLM, provided research funds in the past to help create the private organizations that are seeking to have NLM's policies changed. The contributions of Dr. Cummings, who has announced his intention to retire, are deserving the highest award that this country can bestow. He has been a unique figure in the parade of

those public-spirited persons who rose to the challenge of modern information needs and brought progress in American and world science communications. With the passage of time and the growth of legends, he will be recognized for what he and his associates at the National Library of Medicine accomplished. Incidently, Dr. Cummings is the last remaining member of the Committee on Scientific and Technical Information, Federal Council for Science and Technology. His departure from the government will draw the curtains on a remarkable, productive era,his own as well as COSATI's.

The purpose of this section was to show how Federal agencies responded to the challenge to establish or upgrade their STI programs. Only a few of the agencies have been mentioned to underscore the point. But it would be utterly wrong to think that they were the only ones. Others that also responded include: Commerce, Transportation, Education, Interior, State and Veterans Administration. Also participating in COSATI programs, as well as improving their own STI efforts, were: the Agency for International Development, Central Intelligence Agency, Postal Service, Smithsonian Institution, Federal Communications Commission, Office of Telecommunications Management, Budget Bureau, General Services Admnistration, Library of Congress, Patent Office, Small Business Administration, U.S. Information Agency, and others. It was understood that even if an agency did not have a specific R&D program that produced STI, it had an interest in the use of new knowledge, and certainly a need to know more about new information and communication technology and systems as they positioned themselves to move into the Information Age. During the early 160s, there was no doubt but that the leadership in information matters resided in COSATI and its member and observer agencies.

1.11 The National Science Foundation Given a Key Role in Achieving National Progress

The United States made extraordinary progress in science and technology during World War II. The achievements of the Office of Scientific Research and Development. The Department of Defense is to be singled out for the work of the Office of Naval Research and counterpart organizations in each of the military services. The Atomic Energy Commission created a strong program in both its own laboratories and in contract facilities, mostly conducted by universities. The National Academy got a face-lift and through its National Research Council became very active. In his retrospective about this era, Bronk writes:[1]

> "The National Science Foundation was created in the spring of 1950 by an Act of Congress after 5 years of discussions regarding its role and structure...1950-1951 was a remarkable period. It was the beginning of 12 years during which there was strong support of science by Presidents Truman, Eisenhower, and Kennedy. Science flourished in all branches of the government. Vannevar Bush was still the vigorous, wise creator and catalyst of scientific institutions... On 6 April, the President appointed Alan Waterman, formerly deputy chief and chief scientist of the Office of Naval Research, first director of the Foundation."

What was it that the National Science Foundation Act of 1950 called on Waterman to do relevant to scientific and technical information? Section

3. (a) The Foundation is authorized and directed -

(1) to initiate and support basic scientific research and programs.

(3) to foster the interchange of scientific information among scientists in the United States and foreign countries.

(4) to foster and support the development and use of computer and other scientific methods and technologies...

(6) to provide a central clearinghouse for the collection, interpretation, and analysis of data on the availability of, and the current and projected need for, scientific and gechnical resources in the United States, and to provide a source of information for policy formulation by other agencies of the Federal Government.

Section 11 (g) called on the Foundation to: ...publish or arrange for publication of scientific and technical information so as to further the

[1] Bronk, Detlev W., Science Advice in the White House- The Genesis of the President's Science Advisers and the National Science Foundation, Science, Washington, D.C., October 11, 1974, 6 pages.

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service or to have it done by others. NSF wisely chose the former. It called on NSF to use new information technology and techniques in the effort, thus giving OSIS a research function that specifically added to the authority of the National Science Foundation Act of 1950. It required the Foundation to set up an advisory group made up of public and private sector officials, thus broadening the OSIS effort into a national program. It also brought the directors of the three national libraries into the program, a device that increased coordination and cooperation between library and information service programs in the Federal government.

The Foundation was now well on its way to play one of the most important roles undertaken by a Federal agency to improve Federal and national scientific and technical information programs. The elements of the NSF response were presented by the Director of the National Science Foundation, Alan T. Waterman, to the Subcommittee of the Senate Committee of the Senate Committee on Government Operations, on June 25, 1958. He stated that the responsibilities of the Foundation are:[1]

> 1. Monitoring and assessing both domestic and foreign information activities and acting as an information center regarding these activities.
> 2. Initiating or stimulating studies that will identify problems that need attention.
> 3. Fostering cooperation and coordination among Federal agencies and non-Federal organizations in programs engaged in scientific information.
> 4. Identifying inadquate service and taking steps to establish activities to improve them.
> 5. Identifying gaps in servicesand taking action to fill them.
> 6. Assuming leadership among agencies and organizations in the achievement of an adequate national scientific and technical information service.

The Introduction in the document is worth summarizing because it showed the depth of understanding of the needs at that time:

> "The consumption of fundamental science by the technologies is increasing at a very rapid rate. Where formerly the time lag between the development of a fundamental idea and its utilization by technology was measured in tens of years, it is now measured in months and weeks. Within weeks after the development of a decay scheme of thorium, for instance, plans were developed to build reactors to utilize this dis-

1 Author not listed, Information for Scientists - A National Program for Increasing the Availability of the Results of Scientific Research, Science Information Service, National Science Foundation, Washington, D.C., NSF-58-34, pp 11.

full dissemination of information of scientific value, consistent with the national interest..."

The program started in 1952, as explained by Adkinson:[1]

> "...when NSF established the Office of Scientific Information (OSI) with Robert Tumbleson as head. OSI was part of NSF's Public Information Office...
>
> "In October 1955, the Foundation expanded the OSI program when Alberto Thompson became head. In 1957 two unrelated events made a big impact on NSF/OSI. The first was the untimely death of Alberto Thompson and the second, the launching of the (Soviet) Sputnik (which) surprised most Americans. Congress asked the Federal R&D agencies why the Soviet capacity in rocketry had not been foreseen...and why the U.S. scientific and technical services were not able to forecast such an event. During this period of almost hysteria, Burton W. Adkinson became the head of the Office of Science Information..."

Despite the flurry of activity that was beginning to take place in the National Science Foundation, Congress was not pleased with the progress. Consequently, it passed Public Law 864-85th Congress, Science Information Service, in 1958. Section 901 of the law called for two actions on the part of the National Science Foundation:

> "The National Science Foundation shall establish a Science Information Service. The Foundation, through such service, shall (1) provide, or arrange for the provision of, indexing, abstracting, translating, and other services leading to a more effective dissemination of scientific information, and (2) undertake programs to develop new or improved methods, including mechanized systems, for making scientific information available."

Section 902 of the same Act called for the setting up of an advisory group to the Head, Science Information Service, as follows:

> "The National Science Foundation shall establish in the Foundation, a Science Information Council, consisting of the Librarian of Congress, the director of the National Library of Medicine, the director of the Department of Agriculture Library, and the head of the Science In formation Service, each of whom shall be ex officio members, and 15 members appointed by the Director of the National Science Foundation...It shall be the duty of the Council to advise, to consult with, and make recommendations to, the head of the Sicnece Information Service..."

The Act achieved several objectives. It gave the Foundation a choice of operating a

1 Adkinson, Burton W., National Science Foundation - Science Information, Annual Review of Information Science and Technology, ASIS, Washington, DC, 197 , pp 154-177.

1.11 continued

covery. There is more time lost--and therefore, more time to be gained--between the laboratory and the drawing board and the production line. And it is in the former period, where ideas rather than physical materials are involved, that speedup is most feasible. Ideas have no intertia; their occurrence can be accelerated infinitely--subject only to the limits of our skill and facilities for information processing. The less time scientists need to spend in searching out what is already known, the more time they can spend actively on research. Thus improvements in scientific information facilities will be reflected in improved utilization of scientists'time--in effect, this is equivalent to an increase in the number of available scientists. Quoting the President's Committee on Scientists and Engineers, "A ten percent improvement in the utilization of scientists and engineers would be equivalent to a ten percent increase in the supply."

Basic program objectives in the NSF are to improve present information services utilizing knwon and tested procedures and to develop new and more powerful techniques which will assure success in coping with the rapidly expanding body of scientific and technical literature. The aim would be to ensure that any U.S. scientist can obtain any item of scientific information he needs, no matter where it originates; and to develop improvements in the organization and availablity of scientific information on behalf of all U.S. scientists."

The 1950 and 1958 laws represent the basis for the NSF scientific and technical information program, but there was one more that gave NSF responsibilities in this area. This was the Agricultural Trade and Development Act, Public Law 83-480, as amended by Public Law 85-477, and further interpreted by Executive Order 10900, January 6, 1961. The Act gave NSF the responsiblity of coordinating and administering PL-480 for the Federal agencies, employing excess or special foreign currencies obtained through the transfer of agricultural products to certain countries. With these funds, NSF was able to collect, collate, translate, abstract, and disseminate scientific and technological information originating in other countries. There were several letters and Executive Orders emanating from the Office of the Science Advisor that further directed and clarified the coordination and other actions pertaining to Federal scientific and technical information reports. These dealt with roles of NSF and COSATI, page charges, and standards, among others.

At this point, special attention should be given to the report of a special subcommittee of the President's Science Advisory Committee, chaired by Dr. William O. Baker, then Vice President (Research), Bell Telephone Laboratories. It was this report that

caused the President to "approve a plan designed to help meet the critical needs of the Nation's scientists and engineers for better access to the rapidly mounting volume of scientific publication."[1] Some additional excerpts of the press release are provided:

> "Acting upon the recommendations of his Science Advisory Commit the President directed that the NSF take the leadership in bringing about effective coordination of various scientific information activities with the Federal government. (He) asked that all Federal agencies whose programs involve scientific information cooperate with and assist the National Science Foundation in improving the Government's own efforts in this area...The Committee urged that fullest use be made of existing information services, both public and private, and that the Foundation's Science Information Service supplement rather than supplant present efforts...The Special Assistant to the President for Science and Technology and Chairman of the Science Advisory Committee, Dr. James R. Killian, Jr.commented: "Science and engineering are largely built on the published record of earlier work done throughout the world. There are, for example, 55,000 journals appearing annually, containing about 1,200,000 articles of significance for some branch of research and engineering in the physical and life sciences. More than 60,000 different books are published annually in these fields, while approximately 100,000 research reports remain outside the normal channels of publication and cataloging. Within this vast body of world-wide scientific information, published and unpublished, lie the technical data that scientists need in order to do their work. The situation is further complicated by the fact that a large and important proportion of the world's literature appears in languages unknown to the majority of American scientists, such as Russian and Japanese."...The Committee noted the fact that the services rendered by many of the scientific societies and professional institutions to the scientific community in the information field are world famous for their quality. It expressed the hope that such private groups would continue to cooperate with and assist the Federal Government in the achievement of long-range solutions to scientific information problems."

The Baker Report will be discussed in more detail later in this book, but suffice it to say that the contributions of Baker and his outstanding panel in defining the problem and providing some answers will be long remembered. Detlev Bronk, whose quotation opened this section on the National Science Foundation, was a member of the PSAC panel by coincidence. The section was designed to show what NSF was asked to do and how it organized itself to do it. At that time, it got the message.

[1] Anne Wheaton, Associate Press Secretary for the President, the White House, A Report of the President's Science Advisory Committee, Improving the Availability of Scientific and Technical Information in the United States, December 7, 1958. 8+ pages.

1.12 The Three National Libraries Play an Integral Role

Since the end of World War II, the so-called three national libraries - Library of Congress, National Agricultural Library, and National Library of Medicine - have recognized the need for greatly improved information policies, planning and services. They have worked together and individually to achieve progress, even though their different missions and their positioning in the Executive and Legislative Branches of the government have inhibited full and continuing cooperation in some areas. Inability to act in a monolithic manner is an impediment to progress, but the general good will that they share has made it possible for them to contribute to some improved library and information delivery operations.

The three libraries have recognized the need to employ modern information technology in their programs. They have recognized the requirement to work with other libraries in all fields and sectors. And they have recognized that they are expected to provide leadership in their respective fields. They have worked out a modus vivendi dealing with coverage to minimize duplication and overlap.

In essence, the two Executive Branch libraries, the National Agricultural Library and the National Library of Medicine, are research libraries, whose holdings are devoted to agriculture and biomedicine. Both have been pioneers in the development of information and data bases and delivery networks. Both of these libraries were very active on the Committee on Scientific and Technical Information (COSATI), Federal Council for Science and Technology, from its inception in the early 1960s. Both participate in the work of the Federal Information Managers group, the informal committee that remains the lineal descendent of COSATI. Just as the library community views the three national libraries as members of the library world, the information science and technology community regards NAL and NLM as charter members in the scientific and technical information community. The Library of Congress has been immersed deeply in COSATI and Federal Information Managers activities from the early 1960s, largely because of the considerable focus on scientific and technical informa-

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tion matters at the Library of Congress. An even closer relationship has existed between LC's Congressional Research Service and the Federal STI community since World War II. Robert Chartrand, Jane Bortnick, Jean Paul Emard, and Louise Becker have all worked closely with COSATI and its successor for many years. Robert Chartrand has been regarded by all government professionals in the field as the STI expert in Congress. His extraordinary knowledge of the Federal STI scene is reflected in his "five-foot book shelf" of writings on this and related subjects. Chartrand is regarded as a valuable intellectual resource whose interest in achieving progress in the information field is second to none. Jane Bortnick is now regarded as the expert in international information matters in Congress. The former Deputy Librarian of the Library of Congress, John Lorenz, and the current Deputy, William Welch, have worked closely with the Federal STI community over the years. Both have also been very active in the affairs of the National Commission on Libraries and Information Science, representing the Librarian of Congress who by law is a member of NCLIS. Few people outside of Washington are aware of the close relationship that exists between the national library and Federal STI personnel. The continuous interaction that takes place within this community at meetings, colloquia, seminars and luncheons is useful and productive. When COSATI established a Task Group on National Systems during the mid-1960s, the representatives of the national libraries were fully involved in the discussions and meetings that took place. When the Library of Congress began its program to achieve access to the literature through electronic means, when it began to pioneer in creating the MARC (Machine-Readable Catalog) data base in the 1960s, the leader of the poject, Henriette Avrams, convinced COSATI that it should work on a similar project to cover technical reports. In turn, the author of this book and other representatives of the Federal information community served on standards and other groups established by the Library of Congress. Throughout the years, representatives of the three national libraries and the Federal information community have appeared on the agendas of literally hundreds of meetings sponsored by groups in the public and the private library and information sectors. Considerable mutual respect

exists within the Washington information community that overshadows by far the results of the friction that naturally results from the parochialism of organizations.

An accurate sign of importance in Washington is the extent of funding that a Federal organization is able to attract. All three national libraries should be regarded as important, if their building programs represent a key criterion. The modern new Madison Building across the street from the magnificent old Library of Congress, the beautiful new Lister Hill Center for Biomedical Communications looming over the exquisite National Library of Medicine, and the monumental National Agricultural Library looming as on guard over the busy Beltway around Washington, D.C., a few miles away from the National Library of Medicine, all underscore understanding of their key roles in an Information Age. Coincidently, the Defense Technical Information Center and the National Technical Information System center, while not as elaborate as the two national libraries, are also located on or near the Capitol Beltway, which now can be called the "Federal Information Beltway." Perhaps, there will be others in the future. One candidate could be the "Library of Presidents", the home for the collections of future Presidents. Such a library could reduce the proliferating costs of individual presidential libraries. To sweeten the pot, the Capitol Beltway could be renamed the President's Library Beltway. Just a thought.

The arrival of "Big Science" ushered in the explosive growth of Federal scientific and technical information systems. The three national libraries responded with the elaboration of modern information systems. It is obvious that there are other Federal libraries serving the Departments of Defense, Energy, Interior, Commerce, Housing and Urban Development, Environmental Protection, NASA and others. Their functions are similar to those of NAL and NLM, but they are not considered to be national libraries. Perhaps they should be. During the mid-1960s, some thought was given to this possibility. This will be explored in the section to devoted to COSATI.

The purpose of this section was to affirm that the three national libraries did respond to new information needs in a positive way. Some of the programs that they

espoused will be written about later in the book. Unless it has changed recently, it should be pointed out that the Library of Congress and the National Library of Medicine have been designated as "national"libraries by legislation. The National Agricultural Library has been designated as a "national"library by the U.S. Department of Agriculture in the past. This is mentioned because of the difficulties NAL has had in the last few years to obtain funding and other resources comparable to the two national libraries. In consideration of the importance of the agricultural information programs of the Federal government and the contributions of the Department of Agriculture to what was and may still be one of the most outstanding information programs in the world, legislation should be sought to make the National Library of Medicine a national library *de jure*. Whether or not this happens, steps should be taken to restore the authority, respect and funding that Dr. Foster Mohrhardt enjoyed during the 1960s when he was the Director.

1.13 Government Commissions and Advisory Groups

Recognition of the disruptive powers of the information revolution by the United States Government as a post-World War II phenomenon was seen in the 1960s, resulting in the formation of several information-focused commissions and advisory groups by Congress and the Executive Branch. It is not the purpose of the author to go into a detailed description of each of these organizations; such an endeavor would be valuable as a separate study, perhaps. But for the purposes of this history, they have to be mentioned because they provide enlightenment of the deep concern a number of problems generated in government and the country by the arrival of the information revolution.

The Federal Communication Commission came into being decades before, as did the Federal Trade Commission. As is the case of all mission agencies and study groups, they were created to solve particular problems. The former was formed to regulate common carriers - telephone and telegraph companies for the most part. It was made up largely of lawyers expert in rate-making and rules formulation. The Commission not prepared for the onslaught of new information technology and the marriage of communications and the computer reeled under the impact. Not having a research and development arm, it suddenly had to go into a learning mode in the midst of intense turmoil, resulting from the birth of new industries, new demands, new challenges operating on a national and international scale. Since there were many signals of the impending changes in earlier years, it is mystifying that FCC did not seek to transform itself into an organization that could cope with at least some of the new requirements. There is some suspicion that at least one reason for the FCC's drive for deregulation in subsequent years derived from its frustration in trying to wear its mitre with dignity, i.e., cope with the realities of the new information scene. FCC's dilemma was similar to the plight

of Tolstoy's monkey as related by Ralph Siu.[1] A monkey was carrying two handfuls of peas. One little pea dropped out. He tried to pick it up and spilt twenty. He tried to pick up the twenty, and spilt all. Then he lost his temper, scattered the peas in all directions, and ran away. Obviously, this tale is a caricature, an exaggeration of the reality. But it is true that FCC was not adaptive, ready for the cascade of events that followed not sequentially but in droves.

Another example of FCC's problems with the unexpected came in the years 1977 and 1958 time-frame. This time FCC was hit with the citizens band radio craze and the problem of licensing. According to FCC figures, there were about 20 million licensees, representing about 18 percent of U.S. households in 1977.[2] The problem became so severe as the fad grew that FCC virtually stopped listing the license requesters. It had to contract with the National Technical Information Service to make up computerized lists of CB licensees, which were popular to advertisers.[3] One should not be too hard on FCC for not being prepared. The truth of the matter is that information scientists and futurists hardly detected the rapid arrival of the CB radio. Only the Japanese seemed to be ready, since they virtually took over the market for CB radios.All but four U.S. set makers were able to survive, according to Strange. Scholars will be studying the root causes of the CB radio fad for years. Aside from a permanent group of users, truckers and other motorists, it would appear that the fad has helped precipitate the growth of mobile telephones and cellular phone service in metropolitan areas. FCC's decisions on who gets the licenses in cities across the country to operate in the top 30 markets are anxiously awaited by hordes of competitors.

1 Siu, Ralph G.H. T-Thoughts on R&E Management, The Army Research Council, Washington D.C., January 1965, pp 112. (The publication contains 222 T-Thoughts written by and for scientists.)

2 Aug, Stephen M., Your Average CBer: A Speed-Trap Hound,Washington Star, March 18, 1978.

3 Strange, E.Z., Domestic Manufacturers Ask Carter for Relief, Washington

1.13 continued

In recent years, the Commission has recognized the need for more internal study back-up, and has installed a chief scientist to provide the kind of advice and help that it has needed for years.

Not only had the FCC become 'unhinged' by the winds of change, the Federal Trade Commission, protector of the citizen against monopolies and trusts, has also been a victim of the extraordinary changes brought on by new information technology. But the regulatory responsibilities of this Commission have been more affected by Administration efforts to reduce the Federal government presence than by any other factor. The point to be made here is that this Commission proved not to be the Federal agency that could be called upon to act as a buffer with the arrival of the Information Era. We will have to look elsewhere.

The elsewhere turned out to be a series of permanent and ad hoc groups. Some of these had fairly early antecedents. They were formed in the past and continued on often as vestigial groups whose mission received little attention and whose workload was insignificant. Some disappeared during the 1970s when there was a strong effort by the Administration to reduce marginal commissions and advisory groups through "sunset" legislation. Some of these bodies were the Federal Records Council, the National Historical Publications and Records Commission, the National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research, the U.S. Advisory Commission on Information, and the National Commission to Preserve the Confidentiality of Health Records. None of these groups was well known, except in narrow circles, but their existence indicated that specific problems had arisen and the more well known organizations were not asked to expand their efforts to help solve these problems. There were other groups that were involved in information and communications areas fully or partially. One of these is the Securities and Exchange Commission. This group has been active in protecting the public from the actions of "insiders" who are able to obtain and exploit securities information

1.13 continued

for their own gain, information not available to those outside these organizations. Yet others were: the Public Documents Commission, the Commission for the Review of Federal and State Laws Relating to Wiretapping and Electronic Surveillance and the Interagency Classification Review Committee. These were established to help on standardizing archiving, protection of civil rights, and uniformity of classification of Federal documents, respectively.

The Privacy Protection Study Commission was brought into being to seek ways to strengthen the protection of individuals against inroads on his or her privacy. As a result of its work and that of Congressional Committees, laws were passed to codify protective statutes. During this period in the 1970s, the media gave considerable coverage to the crusade. Also in this period, the Domestic Council Committee on the Right of Privacy was formed by Vice President Nelson Rockefeller and directed by Quincy Rodgers. It was this Committee that surmised that the privacy issue was but one of several information issues that needed attention. After completing its work on privacy, the Rodgers panel produced a unique report on national information policy that will be discussed subsequently in this book.[1]

Another Commission that received wide attention was the Commission on Federal Paperwork. This Panel came into being because of the irritation of the public with the mountains of excessive paperwork and red tape required by governmental agencies in furtherance of their missions. It was also recognized that the cost of the paperwork was rising in the government and the private sector over the years and that this was distinctly counterproductive. This was the era of the "impact statements." There was a growing tendency to require these in the building of new facilities and plants by the Environmental Protection Agency. There was hardly any requirement that the impact statements be read by those who demanded them. Some of them were *pro forma*, a check list requirement that affected industry and Federal agencies alike. The effort to

[1] Rodgers, Quincy, et al, *National Information Policy: Report to the President of the United States*, Domestic Council Committee on the Right of Privacy, Executive Office of the President, Washington, D.C. 1976. (Published by the National Commission on Libraries and Information Science, Washington, D.C., pp 233

reduce Federal paperwork is not new. Other Presidents in the past have directed the Federal agencies to reduce the paperwork load on the populace. The Paperwork Commission was not designed to be a permanent body, hence it was terminated some time after it completed its final report.[1] Unlike many reports of this kind, the report did receive attention. In 1981, the Paperwork Reduction Act was signed into law by President Carter as one of his last acts in government. The creation of the Office of Information and Regulatory Affairs in the Office of Management and Budget may be one of the far-reaching effects of the work of the Paperwork Commission that will influence the way information is handled and managed in the Executive Branch.

Two additional commissions formed during the period were the National Commission on Electronic Fund Transfers and the National Commission on New Technological Uses of Copyrighted Works. The first of these explored the rapidly arriving world of national and international transfer of funds through electronic means. The second, familiarly known as CONTU, was formed to make recommendations about the protection of intellectual property. largely copyrighted materials.

The last commission to be mentioned is the permanent U.S. National Commission on Libraries and Information Science, which came into being early in decade of the 1970s. This small, independent Federal agency was launched by the 91st Congress with several responsibilities. Public Law 91-345 states:[1]

> "Sec. 2 . The Congress hereby affirms that library and information services adequate to meet the needs of the people of the United States are essential to achieve national goals and to utilize most effectively the Nation's educational resources and that the Federal Government will cooperate with State and local governments and public and private agencies in assuring optimum provision of such services... There is hereby established as an independent agency within the Executive Branch, a National Commission on Libraries and Information Science..."

1 Commission on Federal Paperwork, Washington, D.C., Information Resources Management Study, Final Report, September 9, 1977, pp 183.

1.13 continued

Much can be written about the accomplishments of NCLIS in the first decade of its existence.Its stewardship of a large and well attended White House Conference on Library and Information Services in 1980 is perhaps the best known of its many endeavors. But NCLIS has made many contributions in planning, continuing education, intersectoral (public and private) cooperation, dissemination of information, networking, advice to Congress, the Executive Office of the President, States and Federal agencies.

Like the other commissions and advisory groups, the National Commission on Libraries and Information Science came into being at a time of need, when the standing Federal agencies, bureaus and commissions were not prepared to cope with the changes brought on by new information technology primarily, but also other social, political and economic factors. Interestingly, there has never been a strong movement to create a Department of Information or a Department of Communication, even though the dynamics of the information revolution are probably magnitudes of strength above those of transportation or environmental quality.

Gardner [1] once wrote:

> "Because of failure to design institutions capable of continuous renewal, 20th century societies showed astonishing sclerotic streaks. Even in the U.S., which was then the most adaptable of all, the departments of the Federal Government were in grave need of renewal; state government was in most places an old attic full of outwarn relics; local government was a waxworks of stiffly preserved anachronisms; the system of taxation was a tangle of dysfunctional measures; the courts were crippled by archaic organizational arrangements; the unions, the professions, the universaties, the corporations each had spun its own impenegrable web of vested interests. Such a society could not respond to challenge. And it did not.

Even if Gardner is half-right in his assessment of our key institutions,

1 Gardner, John F., How 20th Century Civilization Collapsed, Washington Post, June 9, 1968.

1.13 continued

it can help explain why all kinds of problems and crises overtake us and we appear to be incapable of finding and implementing solutions. Why this is so is explained by Gardner[1] as follows:

> "One of the reasons is that people interested in improving our society never quite come to grips with the complex and technical processes by which it functions. They are preoccupied with specific evils that must be corrected...(T)he result is that each reformer comes to his task with a little bundle of desired changes. The implication is that if his reforms are carried through, the society will be wholly satisfactory. That is a primitive way of viewing social change. The true task is to design a society (and institutions) capable of continuous change, continuous renewal, continuous responsiveness."

If Gardner, who was the Secretary of Health, Education and Welfare a few months earlier, could have reached what amounts to a negative reading about the perfectability of man and his institutions, he would have at least appreciated that the Federal government had in its spastic, muddling way sought to address the information revolution issue by creating a number of commissions and advisory groups to act as pathfinders. That success has been illusive, on the whole, should surprise no one who knows how hard it is achieve successful consensus that leads to progress, especially in complex situations. Since information is everybody's business in government, the notion of a capping agency to monitor the myriad of programs involving information and communication is bound to be resisted.

1 Gardner, John W., What Kind of a Society Do We Want?, Washington Post, September 23, 1969.(Inserted by the Reader's Digest)

1.14 The Emergence of the U.S. Commercial Information Sector

The commercial information sector has a long and illustrious history in the United States, preceding the creation of the Constitution of the United States. It was intertwined with the appearance of newspapers, newsletters, and political tracts from the early days of the colonies, well before the First Continental Congress met in Philadelphia on September 5, 1774 and December 15, 1791, when the Bill of Rights became a key part of the Constitution of the United States.

Perhaps more than any other American, Benjamin Franklin may be considered the exemplar of the commercial information enterprise. Born in 1706, Franklin distinguished himself as a scientist, a public servant and a diplomat, but he was also a printer, an author, an inventor and a publisher. He was the public printer of Pennsylvania, New Jersey, Delaware and Maryland. He held partnerships or had working arrangements with printers in the Carolinas, New York and the British West Indies. He helped organize the Library Company of Philadelphia, one of the earliest of the many American subscription libraries. His call in 1743 for "a constant correspondence" of virtuosos (men of scientific interests) throughout the colonies resulted in the following year in the formation of the American Philosophical Society. He was one of two deputy postmaster generals for the colonies, elected in 1753.[1] Franklin's public office has been long forgotten. Diplomat and printer, as well as the prototype entrepreneur of the commercial information sector, are what Franklin will be remembered for in American history.

Having thus dubbed Franklin as the Father of the Commercial Information Sector, there is yet another deep root to be uncovered and described.

1 Benjamin Franklin, Encyclopaedia Britannica, pp 691-694, 1960 edition.

1.14 continued

As pointed out by Robert Minor [1], three years after the Constitution was signed, the first ten amendments were tacked on to it - the Bill of Rights - providing for freedom of speech, worship, assembly; the right to petition the government; and freedom of press. Thus was the press established, in effect, as an independent institution beyond the normal controls of government and as an exterior check upon the three formal branches of government and their activities. The independence of the press as it has sought to provide an exterior check on the affairs of government has been a thorn in the side of government from the day the Bill of Rights was signed. A Niagara Falls of ink has described the number of battles and skirmishes between the witnesses and the witnessed in the intervening years. The power of the press has been magnified with the arrival of the radio and television, increasing the size of the conflict. As local, state and Federal governments have grown in intervening years, they have become larger and often more vulnerable targets for the media. It is quite interesting that the commercial information sector identifies itself with the news media as the legitimate vehicle to disseminate government information, while at the same time employs the right of petition to the Federal government to convince it that is usurping the ordained role of the private sector when it disseminates information that it generates or pays to have generated. The private sector spokesmen who maintain this absolutist position - not all of the private sector does so - have been criticized for extending the interpretation of what the Bill of Rights means. Hence, the battle continues to rage.

Because of the literal explosion of information and data in recent years, the number of disseminators in the commercial sector has grown considerably. Both the public and the private sectors have been forced into the

1 Minor, Dale, The Information War, A Tower Public Affairs Book, originally published in hard cover by Hawthorn Books, Inc., New York, New York. 1970, 250 pages

1.14 continued

intense use of electronic information machinery. The expanded development of data bases and networks to deliver data in both sectors has resulted in both friction and cooperative ventures. As the commercial sector seeks opportunities to expand, government programs that were hitherto accepted and often admired as facilitators and pioneers of the new information delivery systems become targets. Several of these government programs are centered in science, technology and medicine. The insulation that has surrounded these world-class information programs has frayed to some extent in recent years.

The changing character of the scene is depicted in a paper prepared by A.E. Cawkell [1], who writes:

> "Until about 1968 it was the almost universally held belief that electrical communication was best administered by a 'natural monopoly.' In particular it was believed that telephone communication resources should be allocated as a social right than on the basis of traffic profitability. At about that time it first became evident that cumbersome monopolies would not or could not rapidly adapt to the new communication needs of a wealth-creating minority. Since then, mainly in the United States, the position of communication monopolies has been steadily eroded although traffic 'cream-skimming' by the new entrepreneurs has been limited by governmental action."

Another facet is supplied by Robert Campbell [1], who reveals:

> "About 18 months ago the international group of science publishers known as STM (scientific, technical and medical publishers) met in Basle to discuss new developments in publishing technology. The mood was defensive, publishers reassured each other that the book was here to stay; they were unsure of the new information technology. Last month the same group met in Vienna, and the change was difficult to believe. New concepts in information technology were discussed with confidence and authority. The excellent talk by Derek Barlow describing and estimating the online market and its rapid growth

1 Cawkell, A.E., Electronic Information Processing and Publishing, Problems, Opportunities, Institute for Scientific Information, Uxbridge, Middlesex, U.K., Journal of Information Science 2 (1980) 189-192, North Holland Publishing Company

2 Campbell, Robert, Editor, Blackwell Scientific Publications, Ltd., Bookwatch: Information Technology on the Move, New Scientist, 4 June 1981.

1.14 continued

> was received with enthusiasm. In one study the total revenue of the information industry in the U.S. was estimated at $9.8 billion in 1979, but this is mainly made up of credit, economic and financial information and product, marketing and media information. Speakers predicted rapid growth in the science and technology online market; at present there are 93 U.S. databases in agriculture, life sciences, pure and applied science producing 26 million records while in Europe there are 92 databases in the same subject areas producing 19 million records. Publishers suddenly seem keen to be involved and confident enough to take the initiative. There was little surprise when towards the end of the meeting a major new venture was announced by David Brown of Pergamon on behalf of his company, along with the Dutch company Elsevier, the German Springer Verlag and Blackwell Scientific Publications...to create a machine-readable store of documents from which single articles could be produced at a cost acceptable to users."

The sponsors stated that the system will be attractive because it will give a royalty revenue to the copyright holder for the use made of stored material and take advantage of exciting developments in electronic publishing including online access to original research papers. All relevant publishers could participate in the system which will be operational in the United Kingdom within three years and in other countries rapidly thereafter.

Usdane [1] gives additional explanation why the private sector is eyeing public information banks. She states:

> "The Federal Government of the United States is the world's most prolific publisher. It spends billions of dollars in its three branches, collecting, producing, evaluating, analyzing, and publishing data and information results. Moreover,(it) has created and is continually creating bibliographic and other types of databases which can access portions, and even manipulate large portions of this monolithic published store of information. In many cases, it has even explored the non-Federal published information sector for further valuable primary research results to add to these databases...Private publishers and database creators have in recent years become aware of the immense research value of the Federally-produced or sponsored information and have initiated their own databases; some of these may be devoted exclusively to accessing Federal Government publications."

[1] Usdane, Bernice S., U.S. Government Publications: Their Value, Online Accessibility and Availability for International Information Needs Online Review, 1980, Vol.4,No. 2, pp 143-151

1.14 continued

It would be unjustified to contend that the commercial information sector has emerged merely because of the existence of the rich store of Federal scientific and technical information. For many generations there has been a lively commercial sector that has been publishing scientific and technical texts and journals. They continue to do so with great respect and success. Some of these organizations have branched out into electronic information services; others have joined them more recently. Together they have sought new avenues other than scientific, technical and medical information materials. The marriage of computers and telecommunications has stimulated the growth of far-flung networks that specialize in rapid delivery of databases to all kinds of users. The current and increasing growth of home computers is providing a potentially large audience to use new databases. As the demand for specialized data bases increases, the commercial information sector hopes to make their products available.

Friction between the public and private sector mirrors the sharp competition going on among the commercial vendors themselves, an inevitability that is troublesome, but not fatal. Although the community is far from mute about so-called government "competition", there is more concern that larger corporations will find the field commercially attractive and bring their size and capital to bear on the market.

This is confirmed at least in part by the purchasing of smaller commercial information firms by larger corporations in recent years. This process is expected to accelerate in the future.

of individuals and groups who have expressed their views on the subject. While an encyclopedic national information policy may be too difficult to achieve except for a frozen moment in time, this may not be true for more narrow portions of the information spectrum.

For example, it should not be impossible to formulate a Federal policy related to assisting developing countries with their scientific and technical information needs - apparatus and information. There is no reason to suppose that we cannot work out a policy that covers the interaction between the public and private information sectors engaged in the dissemination of scientific and technical information. The ability to work out a policy to interchange information with friends and allies in the First World and a code that will be instructive in dealing with the countries of the communist bloc should not be beyond our talents. Within the Federal government, we should be able to come up with policies affecting the flow of scientific, technical and other information between the Legislative and Executive Branches, especially data bases filed in computer memories. There is no solid reason that prevents us from working out a policy that ensures the flow of all kinds of information between the Federal, State and local governments. We lack and need a series of policies that relate to information access for all citizens in the United States regardless of where they live. We even lack a policy that delineates what we will count on the marketplace to do in the future, a policy that endures changes in administrations, which may be too romantic an expectation in light of the watershed changes that have occurred in the early 1980s. It is hard to explain why with all of the developments that have taken place in Federal scientific and technical information programs over the years, we still lack a policy to establish and maintain a Federal Scientific and Technical Information System that features electronic interchangability,automatic flow of ongoing research projects and completed technical reports between the

1.15 continued

Federal agencies engaged in similar R&D, and an on-demand capability to serve Congress and other legitimate claimants for such information.

Need for a national scientific and technical information policy was foreseen by a White House Panel in 1976.[1] The report stated:

> "The Congress has recently enacted legislation which re-establishes the position of Science Adviser to the President. The new Science Advisor (the Director of the Office of Science and Technology Policy) will be situated in the Executive Office of the President and provided with staff and membership in theDomestic Council. While the Science Advisor's mandate extends to the entire panoply of national scientific concerns, one specific area to which his attention is directed by the legislation is scientific information. The subject of information policy, to the limited extent that it has been considered in prior years, has tended to be addressed in the congext of scientific and technical information. This was the case during the 1960s, when the focal point within the government for the discussion of information policy was the Committee on Scientific and Technical Information (COSATI), located within the office of the predecessor to the office of the Science Advisor. This continues to be the case in Organization for Economic Cooperation and Development where questions involving information policy are all structurally under the aegis of the Committee on Scientific and Technical Policy (CSTP). Indeed, because of this history, the problems associated with scientific information have often crowded out other information policy problems, and have caused the narrower concern to receive greater attention...The Science Advisor should be the primary focus of policy with respect to scientific information...the exercise of this function should be tempered with the awareness that decisions which are made regarding scientific information can impact upon the broader field of scientific policy generally..."

In the same year, during the 38th Annual Meeting of the American Society for Information Science, held in the Bicentennial Year in the "Cradle of the American Revolution, Boston, Mass.", the subject of a national information policy was vigorously discussed by speakers and the audience.

[1] Domestic Council, National Information Policy: Report to the President of the United States, Report of the Domestic Council Committee on the Right of Privacy, Honorable Nelson A. Rockefeller, Chairman, Washington, D.C. pp 200-201.

1.15 continued

What transpired was recorded by Ruth L. Tighe, New England Library Information Network, Wellesley, Mass. The immediate subject under discussion was "A national policy in information - Is it feasible or desirable? Tighe wrote:[1]

> "In a departure from tradition, the keynote session, "Toward a National Policy in Information," was presented...by keynoter Daniel Bell, Harvard University. From all appearances, attendance records were set here as a large and responsive audience heard Andy Aines (NSF) set the stage for Bell with some pointed remarks on planning for sucy a policy. Citing the absence of coherent national policy in sucy other areas as housing or health care, Bell expressed skepticism that a national plan could be successfully formulated for information handling. In a provocative and stimulating address he proceeded to identify some of the issues and concerns such a policy would have to encompass in today's postindustrial society...Robert Cairns, executive director of the American Chemical Society, spoke to the present emphasis on scientific information and the shortcomings thereof. Mel Day, incoming ASIS president and acting director of the National Library of Medicine, emphasized the importance of national policy planning, but, he said, "we need rationality to go along with the friction of the marketplace." Tony Oettinger of Harvard pointed out that information infrastructures, such as the post office, would have to be accommodated in planning. While Eugene Garfield of the ISI pointed out that private companies must be allowed to retain their role in preserving freedom of information even in a national plan. Panel chairperson Ed Parker of Stanford University stressed the importance of equitable distribution of information to the healthy growth of society as a whole. The debate...spilled over into the press luncheon held for the keynote speakers and continued into that afternoon's second general session..."

As might be expected, consensus was not forthcoming about the possibilities for a national information policy, but what came through was the recognition that the lack of any kind of planning and policy was fraught with danger as marketplace interactions produced frictions, uncertainties and inhibitions. In fairness to the speakers, their recorded remarks are fragments and may not be completely in context with their messages, but Tighe has caught the flavor of the meeting and the

[1] Tighe, Ruth L., Special Report, ASIS 38th Annual Meeting, Wilson Library Bulletin, February 1976, p. 439.

1.15 continued

excitement generated during the vigorous discussions.

There are many other documents on the subject of national information planning in domestic and foreign literature. The Japanese, the Canadians, the West Germans, and the French have produced considerable literature, among others, on the subject. Department of Commerce's NTIA and Congress" Office of Technology Assessment have addressed the subject. Information policy has received wide attention in the work of Congress as it has approached issues in privacy, freedom of information, the revision of communications law, and even scientific and technical information policy. It has not focussed on an overall national information policy and probably will not unless a select committee is formed and that is a small hope.

The last word on the subject is made by Edward M. Lee, president of Information Handling Services, who was the keynote speaker at the Information Association Annual Meeting in 1978. His remarks are abstracted as follows: [1]

> "I doubt that there is a person...in this industry who has not hoped at one time or another for the emergence of a national information policy...I do not mean to suggest that we are without existing policy. Indeed, there is currently a diverse, unfocused stream of policy development. There are also laws and policies in place. But they are neither coordinated nor comprehensive...When (policy is) created in a piecemeal fashion, policy becomes the problem - not the solution..."

How history will judge this generation for not taking the first faltering steps to bring the industry and government together for the kind of dialogue that is so badly needed to blueprint what the country must do in formulating national and Federal information policies time will tell.

[1] Unsigned report, Information Policy; An Approach to the Beginning, The Information Manager, December 1978, p.32.

1.16 The Fluctuating Interest of Scientists in Federal Scientific and Technical Information Affairs

Have scientists in general recognized the implications of the proliferation of scientific and technical information in the United States and abroad? To what extent has the leadership of science and technology taken an interest in the evolving scientific and technical information systems that are changing the relationship of the scientist and the information resources that are the building blocks for the attainment of new knowledge? Is there any evidence to show that scientists are alarmed by the shifts in the control of science communications to a rapidly increasing information services community in the so-called public and private sectors? Have they been aroused by the dramatic growth of personal computers, data bases, networks, and other information technology and techniques that augur the deeper involvement of laymen in the demand for and the flow of scientific and technical knowledge? Are they aware of the emerging problems and issues involving the international flow of scientific, technical and other information and data?

It would be difficult to arrive at any kind of consensus in answering these questions. It is true that individual scientists, especially those active at the bench, have taken to computers and other information technology in their work. It is a fact that scientific societies involved in publishing have sought to modernize their programs to cope with the explosion of literature in their fields. It is conceded that general science organizations, such as the American Association for the Advancement of Science, have provided a forum for information scientists, and have also stepped up their own science communications programs. It is agreed that the National Academy of Sciences-National Academy of Engineering have shown intermittent interest in some aspects of scientific and technical information and its communication in recent years. It is also admitted that the International Congress of Science Unions has shown some concern and activity in this field in recent years.

1.16 continued

While agreeing that there has been some interest and involvement of individuals and organizations in improving scientific and technical information processes and interchange, it also has to be conceded that these are piecemeal actions and not a concerted movement that consciously and cooperatively seeks to harness the new information technology to the oft-professed ends of science in its quest for new knowledge and the application of that new knowledge to the progress of mankind.

What interest influential scientists have had in the Federal scientific and technical information program from the early 1960s resulted primarily by invitations to participate from government rather than by any visible movement on the part of the scientists concerned with the growing problem. These invitations came from the President's Science Advisors and the Office of Science and Technology which they directed during the 1960s. Sight should not be lost of the fact that the initial thrust came from members of Congress. But once the die was cast, there were scientists who played the game. One who anticipated the need for better information programs was Vannevar Bush, who was at one time the President of Carnegie Institution in Washington, D.C. He recognized early that there was something akin to an information explosion and that new methods of "controlling" the literature were required. His solution was the MEMEX concept, a mechanized information utility of the future. Price credits Bush and his colleagues for persuading a suspicious and jealous Congress that basic science was worth supporting for its own sake - or at any rate without inquiring too closely about its connection with practical results.[1] Oddly, there did not seem to be much follow-up by Bush in the library-information area in subsequent years, even though Bush

1/ Price, Don K., Federal Money and University Research, Science, January 21, 1966, paper was originally presented in a Brookings Institution, Washington, D,C. seminar on October 6, 1965.

1.16 continued

did considerable writing in his later years. There are probably some exceptions. He did, for example, write an article that was based on a lecture he made on October 8, 1956 before the meeting of the clinical congress of the American College of Surgeons in San Francisco. He said:

> "A fascinating future surely lies before us, provided that we can escape certain perils, and the most heartening potentialities lie in the field of medicine and the sciences adjacent to it. The time is coming when the practice of medicine will rest securely upon a firm scientific foundation, upon a systematic understanding of the life-processes in all their compexity, and no longer upon the insecure and shifting basis which partially supports it today, with clear understanding in part, but with a great mass of uncoordinated, empirical data necessarily as the main reliance...There may be required new methods of thought, novel ways of recording and transmitting the accumulated experience of the race, ways as yet unconceived of bringing to bear on complex problems the interrelated efforts of diverse minds. We may witness new devices as powerful, versatile, and rapid as digital computers in the realm of computation and analysis, but capable of interrelating and ordering masses of primary and inexact observations into meaningful arrays. There may be means for communicating the knowledge of a group which will render obsolete the cumbersome writing of papers and the chaotic task of storing and consulting them. Certainly, we will see the day - perhaps we should have already - when the public lecture is fully obsolete." [1]

Based on these observations, it would appear to be useful if some young information scientist would carefully comb all of the recorded words of Vannevar Bush and bring them together in one volume. We badly need to bring the wisdom of eminent scientists who have been concerned with science communications into our schools of information science and management. Moreover, we need to pay our community respects to scientists with the kind of vision that Vannevar Bush revealed.

An indicator of early high level interest in scientific and technical information is a document that was prepared and issued by the National

1 Bush, Vannevar, Professional Collaboration, Science, 11 January 1957, pp 49-54. The paper was simultaneously printed in the Bulletin of the American College of Surgeons.

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Another scientist [illegible] made [illegible] strong contri- [illegible] was Alan T. Waterman, [illegible] It was under [illegible] broke ground [illegible] 1980's.

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Another scientist who made a strong contribution to STI programs was Alan T. Waterman, Director, National Science Foundation. It was under his leadership that the Foundation broke ground in this area in the late 1980's.

As long as Waterman remained as Director of the National Science Foundation, there was a conscientious effort on his part to implement the requirements ~~of~~ placed for the Foundation. But this was not the policy of other Federal agencies, nor of the leaders of science, especially those in the Federal government where the R&D programs were growing. An example of this lack is reported by Gray [1], who writes:

> "That the control and effective dissemination of today's flood of scientific and technical information presents serious problems...But my purpose in this article...is to suggest that while we have been worrying like mad about how to arrange the second-floor furniture and where to locate the bathrooms in our information split-level of the future, we may have neglected to insure for it a firm and permanent foundation. I believe that prerequisite to the establishment of such a foundation is realistic recognition of the fundamental relationship of the fundamental relationship that scientific information bears to scientific research, It is the basic thesis of this article that, whereas this kinship actually is of a blood-relation kind, information has been treated by the overall research and development community as a slightly suspect in-law or a cousin several times removed."

Gray, who was associated with the American Institute for Physics for a number of years, concluded his remarks by advising scientists that this blood relationship should be accepted and implemented "to provide a logical, solid and relatively permanent foundation on which to base the multitude of specific activities and studies that are essential to the eventual achievement of a sound, effective, overall U.S. scientific information system."

Among those scientists who did speak out for better scientific and technical information programs is one whose name became a household world in all countries where science and technology are important, Alvin

1 Gray, Dwight E., Information and Research - Blood Relatives or In-Laws?, SCIENCE, July 27, 1962, pP 263-266

1.16 continued

M. Weinberg, physicist and Director of the Oak Ridge National Laboratories. A few months before, the report of the President's Science Advisory Panel, Science, Government, and Information (January 1963) was issued, Weinberg made a talk to AEC Contractor and Depository Librarians.[1] Weinberg, who like Robert Oppenheimer, is an extraordinary thinker and communicator. The first few paragraphs of this presentation should be made must reading for all scientists, engineers, information scientists, statesmen and others. He said:

> "The ancient civilizations of the Indus Valley, in what is now West Pakistan, depended for their existence upon an elaborate network of irrigation canals. The water flow through these canals was regulated by the gatekeeper: he decided who was to receive water, who was not. As time went on, the gatekeepers of the irrigation system acquired more and more power; eventually, according to some historians, they became the rulers of the areas through which the water flowed.
>
> This theory of the origin of the ancient kings of southern Asia has an analogy in our modern science and technology. The ideas and data that constitute science are embodied in its literature. Because science is unified, in the sense that what one scientist does affects and is dependent upon what other scientists do, the proper flow of the information contained in this literature is necessary for the existence of science--in much the same way that the proper flow of irrigation water was necessary for the existence of the ancient Indus Valley civilizations. I shall argue that just as the ancient gatekeepers became kings, so, as our science and technology grow and the flow of information becomes a crucially difficult problem those who control information will acquire a more and more dominant position in the science of the future. All concerned with science and technology--the individual scientist and engineer, the technical society, the documentalist, and the Federal Government--must recognize this trend and must be prepared to devote to control of information a larger share than heretofore of their resources. . . Greater involvement with information will require that the (Federal) agencies assign to the technical information function a definitive high-level position within the agency. I believe that the technical information function, being primarily part of research and development, must be made part of the research arm of the Federal agencies, not the administrative arm. I cannot stress too strongly how important this is: information that is part of administration inevitably loses user-sensitivity, perhaps the most precious attribute of the good information system.

[1] Weinberg, Alvin M., Information, Science, and Government, Proceedings of Conference on the Literature of Nuclear Science - Its Management and Use, September 11-13, 1962, U.S. Atomic Energy Commission, Division of Technival Information Extension, Oak Ridge, Tennessee, pp 241-249.

1.16 continued

> "Whether or not the information handling scientists will become, as did the gate-keepers in the Indus Valley, a dominant priesthood of science, time alone will tell...The essential point is that coping with information has become a major problem in research and development, and the agencies, the technical community, the individual scientist, each must allocate more of his resources to the problem. Should we do less our science will fragment and crumble. I am confident that all those who have hitherto been unaware of this problem will awaken, before it is too late--that they will come to the assistance of the professional documentalists and librarians who have devotedly, and single-handedly, exerted themselves so bravely to maintain science as a unified and viable entity."

A few months later, the White House released the report of the President's Science Advisory Committee, Science, Government, and Information, which circulated in the United States and the rest of the world with extraordinary speed. To the information scientists, the publication became almost a "bible." In the world of scientists, the publication was reviewed and discussed in various professional society fora, and then laid away to rest, hardly to be mentioned again. President John Kennedy was moved to state:

> "One of the major opportunities for enhancing the effectivenesss of our national scientific and technical effort and the efficiency of the Government management of research and development lies in improvement of our ability to communicate information about current research efforts and the results of past efforts...The observations of the Committee deserve serious consideration by scientists and engineers engaged in research and development and by those administering the large Government research and development programs." 1

Some reports bearing the name of a committee or panel chairmen may be the work of that chairman with the rest of the panel playing a soft accompaniment, but this was not so with this PSAC report. Other distinguished members of the panel were William O. Baker (Bell Laboratories). James H. Crawford (Editor, Journal of Applied Physics), Louis P. Hammett (Professor of Chemistry, Columbia Univ.), A. Kalinsky (General Dynamics/ Astronautics), Gilbert W. King (IBM Research Center), William T. Knox (about whom more will be said), Milton O. Lee (Federation of American Societies for Experimental Biology),

1 The White House, Science, Government, and Information-The Responsibilities of the Technical Community and the Government in the Transfer of Information, Washington, D.C., January 10, 1963, 52 pages.

John W. Tukey (Professor, Princeton Univ. & Associate Executive Director, Bell Laboratories, Eugene Wigner (Professor of Mathematical Physics,Princeton University), and Jay Hilary Kelley (OST, Executive Office of the President). Dr. Weinberg has been most generous in his praise of his associates, also Francois Kertesż (Oak Ridge National Laboratories), who acted as the recorder and executive secretary of the study program. The "Weinberg Report" which will be discussed in more detail in this book still remains as useful as it was when written. Unfortunately, newer generations of scientists in and out of the government are unacquainted with it to their own loss and science and technology in general.

The growing importance of scientific and technical information in the Federal government was recorded in a presentation made by Kelsey at a 1963 symposium on biomedical information.[1] In addition to describing the health information programs of the Department of Health, education and Welfare and actions in the Office of the President, regarding scientific and technical information, he quoted a passage in President Kennedy's special health message to Congress he sent earlier in the year. The President said:

> "...the accumulation of knowledge through research is of little use unless communicated in useful form to those who need to use it--to other scientists, educators, practitioners, administrators, and the public. There is now wide recognition that improved scientific communication is an urgent goal, and action is being taken. With the assistance of information developed by congressional studies, I have asked the Department of Health, Education and Welfare to take the lead in developing new methods and systems of utilizing and making effectively available more health research results and information."

Once again, Weinberg returned to the media in 1963 to call for the blending of skills of the professional documentalist and the technical knowledge of the scientist. In an excellent article in International Science

[1] Kelsey, F. Ellis, Government Responsibility for Science Information, presented at the Symposium on Biomedical Information, Fedederation of American Societies for Experimental Biology, Atlantic City, New Jersey, April 17, 1963, 16 pages.

and Technology, Weinberg writes:[1]

> "Initial dissemination of technical literature has, for the last 100 years, been largely by way of the technical journal. Various trends seem to be changing its status. On the one hand, the journal itself has become so bulky, and the number of journals has grown so, that the journals are often not read. On the other hand, private and semiprivate methods of circulation have sprung up - government's informal report system in technology, the preprint system in basic science. Much of the government's original concern with the "information crisis" was prompted by a growing realization that much of the information contained in the flood of government reports was being lost. With respect to preprints, science faces a real danger of reverting to the privacy of the 17th century: some biologists think this has already happened in molecular biology where preprints are often circulated only to one's friends."

This brief excerpt does not do justice to the many lively thoughts expressed by Weinberg in this paper; suffice it to say that his message to scientists, writ large, that they must pay more attention to science communications during an era of transition is still fresh and unfulfilled. Weinberg recognized that the PSAC (1963) paper had upset librarians who thought that they had fared poorly in the study and had this to say on this subject about a year later:[2]

> "The Weinberg of the so-called Weinberg Report would appear to take his life in hand when he agrees to speak before a group of librarians since I have been the librarians' bete noir ever since the report was issued. There is a rumor that a librarian in California ceremoniously burned (it). I should point out though the report criticized librarians, it criticized scientists much more severely. The librarian was depicted as a responsible citizen valiantly trying to cope as best he knows how with the flood of scientific information; the scientist was depicted as shirking an essential part of his responsibilities in the handling of information. I therefore propose that we bury the hatchet and get on with the job at hand. The information crisis is so severe that, even with fullest cooperation between the information and scientific communities, we can hardly expect to resolve it." ...The response to our report has been disappointing. Members of the information community...are all familiar with (it);

[1] Weinberg, Alvin M., Science Communication, International Science and Technology, April 1963, pp 65-74.
[2] Weinberg, Alvin M., Second Thoughts on Scientific Information, College and Research Libraries, November 1964, pp 463-471.

> the government agencies have been in rather a tizzy about information since the report appeared. On the other hand, the technical people - those who most needed needed to be alerted - seem to have been much less influenced by the document. I would be surprised if as much as five percent of the technical community knows about the report, whereas I have yet to meet a technical librarian who has not read at leeast a review of it."

In the same article, Weinberg spoke about an observation made by a member of his panel, Professor Eugene P. Wigner, who was then a recent Nobel Laureate in Physics. Wigner saw science as undergoing a social reorganization in response to its growing problem of communications. Wigner [1] sees

> "the scientific community layering into several hierarchies. At the first level are the bench scientists, each of whom works in a rather narrow field, and each of whom communiccates with other closely related bench scientists. The results of each group of bench scientists are... kept under surveillance by the next group of scientists - the group leaders or bosses. These group leaders communicate with each other, and in this respect maintain contact between different groups of bench scientists. In principle, the hierarchy could be extended with groups of group leaders themselves being kept under surveillance by supergroup leaders who again would communicate with each other at a higher level of abstraction than do the group leaders...The traditional working scientists are at the bottom rung - each one knows almost everything about almost nothing; as one progresses toward the top of the pyramid, the subject matter becomes more abstract until one finally reaches the philosopher at the top who knows almost nothing about almost everything."

Weinberg went on to give examples of how this principle works in real life, concluding with these words:

> "...I see no better mechanism than the information (analysis) center to sift the information flow in the newly organized Wignerian scientific hierarchy. I hope I have made clear to you that, as the information center grows, so will the library that supports the center - and that, in our coming scientific information system, this example of cooperation between librarian and scientist in operation of the information centers will serve as a pattern for the much broader cooperation between scientist and librarian that our ever-growing science will demand."

Having thus made an effort to pacify the research librarians, there is no record of Weinberg effigy burning since.

[1] Ibid, p. 464

Several years later, Weinberg again took up the cudgels displayed in the PSAC Report, "Science, Government and Information", this time in a collection of some of his previous papers and speeches. In this paper, he addressed the science community, pointing out that:[1]

> "The scientific activity that is at once most affected by the expansion of science, and that is perhaps most directly a measure of this expansion, is the scientific communication system. The Malthusian second dilemma - that the communication system grows faster than do the number of communicators - is nowere better illustrated than in the extraordinary proliferation of our system of scientific communication. In some respects the crisis in scientific communication epitomizes many of the contradictions and limitations of Big Science; the problems of science's system of communications can hardly be separated from the problems of Big Science itself."

On this occasion, he said nothing about his disappointment that the science community had not risen to the requirement, but it is doubtful that he retreated from the criticism of scientists. About this, more later.

Although his focus was not primarily on American or British governmental information programs, Ziman [2] picked up the theme to some extent in his essay that Weinberg had explored. As he saw it, scientists were not too greatly concerned with "science" outside of their own specialties, only when there was some breakdown of magnitude in the system or when their papers were not accepted by scientific journals or when they found it difficult to retrieve information from normally available sources. The nature of science and its institutions was grist for the mill of historians and philosophers of science. However, there was nascent recognition that the explosion of literature and scientists all over the world, the increasing costliness of science, and the drift of science towards public issues - these were changing how scientists functioned, how they gathered,

1 Weinberg, Alvin M, <u>Reflections on Big Science</u>, The M.I.T. Press, Cambridge, Mass. 1967, pp. 39-64

2 Ziman, J.M., <u>Public Knowledge, An Essay Concerning theSocial Dimension of Science</u>, Cambridge University Press, New York, 1968, 154 pp.

1.16 continued

used, and disseminated information. Pasternack [1] has been critical of the book and the author, complaining that Ziman placed "too little emphasis on the explosive growth of some fields of science, on the revolutionary advances in computer technology, printing methods, duplicating techniques, and on the growing interaction of science with the general community." This was confirmed in reading the book and in a subsequent discussion with the author when he visited the United States in the late 1970s. Ziman acted like a conservator of the old social structure of the scientific community, concerned that modern information technology would undercut "science" unfavorably in the future. For some of us who were striving to improve and update science communication, the arrival of his book and its message was a disappointment.

But not all was bleak in 1969, for it was in this year that the National Academy of Sciences and the National Academy of Engineering Committee on Scientific and Technical Communication completed its intense study on Scientific and Technical Communication.[2] This report will be discussed in a subsequent chapter, but it should be pointed out that the Committee was made up of a number of eminent scientists, engineers and information experts, led by Robert W. Cairns and F. Joachim Weyl, both eminent men of science and technology. The Committee was made up of about 25 people, who were supported by about 200 consulting correspondents, also scientists, engineers, information managers, information scientists, and others. The study which took three years to complete came up with 57 recommendations for the government and the private sector, emphasizing the need for maintaining the pluralistic, diverse nature of communication activities in

1 Pasternack, Simon, Science, Vol 164, 9 May 1969, pp 669-670. (A thoughtful and objective book review by the editor of the Physical Review, Brookhaven National Laboratory, Upton, New York.)

2 Cairns, Robert W, et al, Scientific and Technical Communication, A Pressing National Problem and Recommendations for Its Solution, a report by NAS and NAE, to the National Science Foundation, June 1969 322 pp.

1.15 continued

science and engineering - as opposed to the creation of any monolithic, centralized system. The SATCOM effort probably was the largest study of its kind, undertaken by the largest cast of highly regarded people from science and technology. Never again in the intervening years was such an effort undertaken to prepare for the Information Age. The scientists and others who had been mobilized by the two academies to serve on the SATCOM panel were dispersed to the four winds, insofar science-communications were concerned. No continuing body was formed by the two academies to continue the work started by the SATCOM group. For most of the participants, it was the last time they devoted any attention to scientific and technical information matters that came to public attention.

One of the scientists who did much to launch better Federal information programs was Wiesner[1], who stated before the Senate Subcommittee on Reorganization and International Organizations:

> "Although the Federal agencies have long dealt with the needs for scientific and technical information in carrying out their missions, the problem has taken on new dimensions requiring concerted action at the Presidential level...Scientific and technical information in Government has become a national problem and can no longer be considered on an agency-by-agency basis..."

Wiesner backed up his words with efforts, a few of which were fruitful, to stimulate a number of actions in the Executive Office of the President and within the Federal agencies to upgrade scientific and technical information programs. In later years, his focus on information shifted somewhat. At a Commencement address at MIT, he said:

> "...Watergate has specifically heightened my professional concerns about the withholding and misuse of information which can powerly affect our ability to maintain a free society...Right now we have communication and information problems which are inhibiting our ability to learn quickly enough about the effects of our collective decisions and respond to problems that arise before they get out of hand...But Watergate is just a symptom of -ore pervasive information problems. The expanding use of data bank and electron-

[1] Wiesner, Jerome J., Statement by Dr. Jerome B. Wiesner, Director, Office of Science and Technology, Executive Office of the President, for the subcommittee on Reorganization and International Organizations, U.S. Senate, September 21, 1962, pp 23-26

[2] Wiesner, Jerome J., Freedom of Information, based on the commencement address of Dr. Wiesner at MIT, Cambridge, Mass, May 31, 1974, and printed in Computers and People, August 1974, pp 26-27

ic intercept devices is emerging as a serious threat to individual freedom...The Bill of Rights has, to an unknown degree, been undercut by new information technology and it must be repaired by legislation...Beyond the misuse of personal information, lack of information caused by secrecy restrictions has been perhaps the most important sincgle source of malfunction of our society during the past quarter century..."

These brief excerpts should be enough to demonstrate to the reader that Wiesner has thought hard about various aspects of information in this troubled era. Unfortunately, his parade of information issues and problems did not include the problems of the Federal agencies that precipitated action during the early 1960s. His thoughts continued to expand, however, on the importance of access to knowledge. He is quoted as saying in 1980:[1]

"Our problem at the present time is not that the world has become much more complex but that we have become a society in which we have let a lot more people have a voice without at the same time figuring out a way to keep the system operating. A multitude of people are now able to participate in the decision-making process -- without adequate knowledge -- and all have either something to gain or something to lose. This leads to paralysis of decision-making. What is needed is re-establishment of a governmental mechanism to end the paralysis..."

The last two quotes reveal that Wiesner believes that government actions are still needed to achieve justice and equity, a view not necessarily shared by leaders in the Administration today. It is hoped that he will join other scientists in calling for strengthened Federal scientific and technical information and communications, as he did in 1962.

The next time that scientists went public with their views about the importance of government and scientific and technical information was in June 1975, during hearings held by the House Committee on Science and Technology on H.R. 4461, National Science Policy and Organizational Act of 1975. Title IV of the bill called for a Science and Technology Information and Utilization Corporation. It turned out that there was little sentiment for such a corporation, but some of the observations made by the witnesses revealed support for strong Federal scientific and technical information programs on the part of several of the witnesses.

[1] "A Conversation with Jerome Wiesner, U.S. News and World Report, August 11, 1980, p. 66.

1.16 continued

Roger Revelle, Chairman, Board of Directors, American Association for the Advancement of Science. He stated:[1]

> "There is wide agreement that broad and prompt dissemination of scientific and technical information in the most usable possible form is of critical importance for the national welfare. Consequently it is most gratifying that your Committee recognizes scientific information management as a vital part of the whole scientific and technological process. Moreover, it seems clear that Federal intervention and support are necessary in this area, because of sheer volume, complexity, and the rate of increase of new information..."

Revelle suggested that Title IV be given further condiseration in concert with concerned public and private organizations.

From Arthur M. Bueche, Vice President for Research and Development, General Electric Company, came the following observations:[2]

> "...The present status of Information Systems Management in the the United States is one of plurality, with many different organizations participating in the process, with competition among all alternative forms of service and alternate organizations...Under these circumstances I'm not convinced that the time is ripe for the creation of a superagency to attempt to dominate this work at the Federal level. Systems are still evolving. Much R&D will be done on the technology required and an organization charged only with operation would be isolated from this evolving technical effort. Even more important, however, I believe that technical organizations generating information need to be held accountable for its eventual use. If they are relieved of this responsibility by creating an intermediate agency to collect and distribute technical information, they are denied access to key feedback information for their program planning - what are their client's expressed needs for technical information. One final important consideration...the creation of a single agency would make it vulnerable to a requirement for the work to be put on a self-sustaining basis. Such a requirement would...prove an insuperable burden for a central organization responsible solely for information dissemination."

Some of Bueche's views about problems that a Science and Technology Information and Utilization Corporation would face are instructive.

[1] From handout at Committee Hearings, June 17, 1975.
[2] From handout at Committee Hearings, June 19, 1975.

1.16 Continued

After stating that he did not believe that the still ill-defined "problem" of management and utilization of scientific and technical information would be effectively dealt with through the proposed corporate approach, Philip Handler, President, National Academy of Sciences, made these observations: [1]

> "The problem is more basic - how to relate and direct available scientific and technical information to specific users interest and needs -- scientific, technical, managerial, and policy. To effect this coupling requires a substantive understanding of the generation of information and its use that is not clearly characterized by the proposed corporation. It is to be found in the large information systems of the USDA, NIH, ERDA, EPA, and NASA, among others, where the possibilities of information tranfer and utilization can be more realistically assessed. This is not to say that a better job cannot be done to promote the transfer and utilization of the results of Federally financed R&D. In my view, the information dissemination problem is only one facet of a complex systems problem that must take into consideration the concepts and characteristics of the underlying R&D process. For this reason, it might be well to include the issue of Federal management of STI in the previously mentioned study of the Federal organization for R&D (that Handler called for in his earlier testimony)."

The sage comments from the late Phil Handler are appreciated, because they remind us that the Federal STI program is an integral part of Federal R&D, not merely an exercise in dissemination of a piece of property. It also reveals how far the Federal STI programs have strayed from the path set during the early 1960s.

Interesting testimony was also forthcoming from Elmer B. Staats, Comptroller General of the United States, U.S. General Accounting Office. It is included, although Mr. Staats, certainly one of themost knowledgeable persons in theFederal government, is not a scientist, because it is relavant to this and future chapters In his view, Title IV was inadequate for a different set of reasons than those offered by Handler. Staats felt

[1] From handout at Committee Hearings, June 11, 1975

that the Title IV proposal would do nothing for technology transfer and utilization of technical information generated by the Federal agencies, a much more important problem. He contended that the Federal agencies' role in developing technology delivery systems needs to be improved, and that the model proposed in Title IV is too limited "in that it is primarily concerned with passive information services." [1]

Testimony from the knowledgeable Bowen C. Dees, President, the Franklin Institute of Philadelphia, was a useful contribution. The gist of his remarks are as follows: [2]

> "Information is costly to assemble, store and disseminate, and must be paid for at a rate approximating its cost. The science community is as hard to convince on this point as the man in the street. Despite our STI system's decentralization in the U.S., it is a superior system for assuring the flow of STI, but it does have curable faults. We have not determined how to provide access to all in the U.S. who should be provided with STI. The wide range of concerns found in viewing the STI problem in its global, pan-discipline, academic/governmental/industrial aspects is difficult for any one group to encompass in its program. The Federal government has primary responsibility for formulating policies, for managing and coordinating its own STI programs, and for fully employing private sector STI services. The NSF Office of Science Information Services (OSIS) is in a unique position to exercise leadership in the broad national interest, not being bound to specific missions... A searching review of OSIS' mission is needed...Creating an information corporation would be unwise. Individual agencies should play key roles in their areas of responsibility. Combining NTIS and SSIE is valid and worth considering. ...Congress should stimulate Federal agencies to give more attention to present operations and future planning in the STI area. The new White House S&T advisory mechanism should strengthen our STI system to include setting up an advisory board for policy development."

The disappearance of the OSIS program subsequently and the lack of a responsive OSTP STI program were undoubtedly bad news to Bowen Dees, but his prescription for needed action is still sound.

1. From handout at Committee Hearings, June 17, 1975.
2. From handout at Committee Hearings, June 12, 1975.

1.16 continued

A leading American scientists who has been an influential voice in science communications on both sides of the Atlantic Ocean is Lewis M. Branscomb, Vice President and Chief Scientist of IBM Corporation. He too commented on Title IV, making some unusally interesting statements after congratulating the Committee for giving the information program the prominence it deserves. He went on to say:

> "The most important issue in the STI field: the means for disseminating the results of research to the intended user must be established concurrently with the establishment of every federally sponsored program. An S&T Information Board is badly needed to help resolve problems about the boundary between government and private sector dissemination roles. Senior line executives of the government R&D agencies rather than information specialists should undertake this role. COSATI was not effective because it was composed of top information specialists of the agencies, who lacked authority and influence in their agencies. The Science Adviser when established should assign to the Federal Council itself a major responsibility for resolving key policy issues relating to STI. NTIS is to be lauded for its efficiency and its philosophy that users should pay distribution costs. .. The OECD study on Information for a Changing Society (which Branscomb helped write) should be given more attention. STI must be make available to all who plan our national life. Scientists are lax in communicating STI. The U.S. should continue its policy of sharing STI with the world. The Federal agencies should be more concerned with making information available to the public."

The only exception to complete agreement with Branscomb's views is the over-simplified reason as to why COSATI was not as effective as it should or could have been. This will be covered later in the book during discussions about COSATI. Suffice it to say at this moment, Federal R&D managers during and after the days of COSATI have by and large been ignorant and unconcerned about Federal STI programs. As Director of the National Bureau of Standards, Branscomb was knowledgeable and concerned, a rare exception. In the intervening years, the lack of interest and concern became stabilized. To ask this group to make key STI policy decisions

[1] From handout at Committee Hearings, June 12, 1975

1.16 continued

based on knowledge, interest and involvement would be an exercise in futility today. Branscomb would probably agree. with the clearness of vision he has always shown in calling for stronger scientific and technical information processes.

Another highly regarded scientist who has been consistent in his efforts to seek higher levels of achievement in Federal and national scientific and technical information is Conyers Herring of Bell Telephone Laboratories. He too provided testimony at hearings of the Committee on Science and Technology. On this occasion, he stated:[1]

> " There are three reasons why new mechanisms for coping with information systems need to be instituted and why the present is crucial for such action: STI services are costly and diverse, there are no Federal mechanisms for policy formulation and coordination, and in the next half decade the nation will face significantly more challenging problems in this area than ever before. Mechanisms are needed in the Executive Branch to insure that national needs are recognized and addressed by appropriate agencies. A central body is needed to identify problems in the information field, to provide focus for US participation in international STI matters, and to interrelated with non-Federal parts of the nation's STI community. An interagency coordinating group, like COSATI, should be reinstated under FCST. OSIS (NSF) should have the responsibility for assembling and organizing knowledge about the programs of the Federal agencies, how they interact with non-government STI organizations, about the needs and habits of information users, and for assessing the "health" of national STI services.... There should be a center to concern itself with the effectiveness of STI services from a broad national point of view. There should be no attempt to centralize control over the wide diversity of information services of the various agencies. OSIS should remain in NSF, but its NDEA legisla- should be changed to add explicit mention of research, monitoring, and stimulation responsibilities."

Based on what has been happening during the last eight years, it would appear that the message did not sink in, since no action was taken on any of Herring's suggestions.

H. Guyford Stever, Director of the National Science Foundation and Science

[1] From handout at Committee Hearings, June 19, 1975.

1.16 continued

Adviser to the President at the time, also testified before the Committee. Included among his comments are the following:[1]

> "In turning to Title IV, I commend the Chairman and Committee for directing attention to the importance of ensuring availability of STI to all who need it. Although I agree that the Federal STI activities need strengthening, I must express reservations about the...(envisioned) Coorporation. Its functions would separate information from the mission agencies, their laboratories and their users, (since) each of the functions requires different kinds of expertise and maintenance of continuing relationships with a variety of national and international interests and organizations. NTIS and SSIE could be combined, but I am not certain that combining them in a public corporation is the best way to go...Unless the authority for the corporation was considerably modified, it could dampen or destroy the growing dissemination capabilities of scientific and technical societies and commercial firms. The research functions, as perfonmed through OSIS can be carried out effectively in NSF. By remaining in the Foundation, OSIS will be able to continue to address the national science information research needs of both public and private sectors, including suppliers and users. In this way, OSIS can help insure the availability of STI to all interested US scientists and engineers...I believe the Director of NSF should work closely with the new science and technology adviser to the President in additional specific steps to be taken in this area."

Within a year or so, OSIS was on its way out and the overall health of the Federal STI system began to turn downwards. This chapter of the story will be covered later in this book.

The last witness in this series to be covered is Edward E. David, Jr., Executive Vice President, Gould Inc. and former Science Adviser to the President. The reader will hear more about the views and contributions of David later in the book, but it is interesting to compare his remarks about Title IV to some of the foregoing. David observed:[1]

> "Finally, with respect to the Science and Technology Information and Utilization Corporation, I believe the functions outlined are beyond question. Generally, I favor a self-supporting organization to carry out these functions. Indeed, in the same sense that advice cannot be impressed on an unwilling subject, neither can information. It can be made

1 From handout at Committee Hearings, June 10, 1975.

2 From handout at the Committee Hearings, June 17, 1975.

1.16 continued

> available but there is no way to force-feed it, Furthermore, making information a "free good" would decrease the likelihood of use and bring unjustifiable costs. NTIS has done a fine job in marketing federal information at a reasonable price, and I see no reason why NTIS could not be self-supporting as a quasi-public corporation, rather than being part of a Cabinet department. Society is becoming more information-intensive, as is portrayed in Daniel Bell's post-industrial society caricature. Thus it is a propitious time to make the move to a quasi-public corporation."

The reference to Bell's post-industrial society "caricature" is puzzling, hence a trip to a Bell article [1] for refreshment. A description of the post-industrial society is one that is "based on services. Life becomes a game between people. (In the pre-industrial society, life is a game against nature and in the industrial society, life is a game against fabricated nature.) What counts is not raw muscle power, or energy; what counts is information. The central person in this society is the professional, for he is equipped by education and training to provide the kinds of skills which the post-industrial society demands. Central to the post-industrial society is the fact that the sources of innovat ion are the codifications of theoretical knowledge." Since David and Bell agree that society is becoming more information-intensive, the answer is probably shrouded in semantics. Nevertheless, the recognition of the importance of information in modern society by Bell is another instance of a scientist, a social scientist in this case, holding up a mirror to reality. There are other scientists: William O. Baker, Donald Hornig, William McElroy, Ruth Davis, Harrison Brown are just a few examples who played a key role in Seeking to improve and extend Federal STI programs. But taken altogether, they represent a very small numerator over a huge denominator of scientsts who still remain relatively unaware of the importance of individual and institionalized science communications.

1 Bell, Daniel, The Coming of the Post-Industrial Society, TWA Ambassador, January 1976, pp 36-38.

1.17 The Explosive Growth of Databases and Networks and Their Augury

So much has been said about the arrival and growth of information and data bases in recent years that saying more about them is an act of redundancy. Data bases, many of them containing scientific and technical information, are being produced and reproduced at an alarming speed. We have not yet arrived at the point where it will be voiced with sadness that the proliferation of information on paper is being matched by the proliferation of data bases, however, but the time might come. That it is costly to create new data bases, there should be no doubt. The endless proliferation of information delivery networks is another matter. The trends and dynamics that have brought about the dismantling of the uncommon carrier that was the Bell System are still operative. Conditions for the growth of electronic networks of all kinds seem favorable for the moment. In the long pull, we will find that we cannot afford too many of them, especially if all they have to offer are marginal advances over their competitors' services.

Another problem with the growth of data bases is that they do not provide anything but an electronic version of what is available on paper. Granted that they facilitate searching through mountains of references, but they do not provide refined or screened information and data. If they cannot do this for the user, what will be the shape of their growth curves in years to come. It is also granted that the development of information data bases is still in its infancy stage; there is no reason to believe that networks will not be able to deliver information and numeric data that have been refined, compacted, thus enriched, to a variety of users.At the moment, data bases have not been designed to solve the problem of complexity. In 1970, Sir Stafford Beer, the well known British cybernetician, told an eminent group of scientists, engineers and members of the U.S. Congress:

> (There is)a reality that does not come in parcels labelled for the attention of appropriate officials. The very stuff of this reality is complexity. The elements of our society ever more tichly interact; the more this happens, the more participation is invoked, the more

[1] Beer, Stafford, Development Director, International Publishing Corp., and visiting Professor of Cybernetics in the Business School of Manchester University, Great

> the streams of data flow...the more complex does society become. Handling complexity seems to be the major problem of our age, in the way that handling material substance offered challenge to our forefathers. Computers are the tools we have to use, and their effective use must be directed by a science competent to handle the organization of large, complex, probabilistic systems.

Beer believes that this science is cybernetics,the science of communications and control. It is his view that the battle with complexity will not be determined by particular innovation nor by some future isolated achievement, and that outcomes are determined by the dynamic structure of the systems we have or may adopt. Further, the most obstrusive outcome of the system that we have is a gross instability of institutional relationships and of the economy. He says:

> This cannot last. The society we have known will either collapse, or it will be overthrown. In either case a new society will emerge, with new mthods of control; and the risk is that it will be a society which no one actually chose, and which we probably will not like...Thanks to the growth of complexity, which is very much a function of the growth of data-handling capacity and of the information explosion, society has outgrown the dynamic regulating capacity of its own hallowed structure. History did not design that structure to cope with such complexity, and a cybernetically grotesque machinery is the result.

After expressing his pessimism about the future of the world - unless his cybernetic approach is adopted by the world - Stafford Beer writes:

> I am fighting for a way through to your real ears. That is exactly to say that I am trying to differentiate, in you, between data and information. Data are a whole lot of meaningful patterns. We can generate data indefinitely; we can exchange data forever; we can store data, retrieve data, and file them away. All this is great fun, maybe useful, maybe lucrative. But we have to ask why. The purpose is regulation. And that means translating data into information. <u>Information is what changes us</u>. My purpose too is to effect change -- to impart information, not data. Data, I want to say to you, are an excrescence. Data are the very latest kind of pollution. We are not going to do anything at all about the management of information and knowledge towards the regulation of society as long as we think in data-processing terms. That is technologically easy. It is what the computer companies and the telecommunication interests would like us to do. Data are assuredly the great new marketable commodities of the nineteen-seventies. But, let me repeat, data of themselves have no value. What has value is the machinery to transform data into information, and the machinery by which that information may be used to innervate society. Society has become a complex organism, and it needs a nervous system. Managing the development of information science and technology is all about this task. There is no other message than this.

As a participant at the 11th Meeting of the Panel on Science and Technology, the author had the good fortune to hear Beer make his impassioned remarks, his plea to

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to the wise men of science and governance to understand the difference between data and information, to consider his view that new machinery was needed to contend with complexity, to attend to his fear that failure to comprehend the arrival of what he believes is data pollution, and to dedicate themselves to the task of improving the management of information science and technology. It would be unfair to state that Beer's message was not understood by his audience or at least some of his audience, but it is true that it did not stimulate the kind of action that Beer was hoping for. Except for a couple of articles in information publications, nothing happened. Members of the American Cybernetic Society were pleased that Beer invoked the name of cybernetics as the way to solve the problem. That was it.

In the meantime, the data bases continued to grow like weeds. Not heard again was Beer's complaint that data are an excrescence. His prediction that data are assuredly the great new marketable commodities of the 1970s was at least partially correct, although it is not entirely clear that they have won for their pioneers huge profits as yet. Whether or not Beer would place data bases in the same "damned" category as data is not clear, perhaps not. On the other hand, it is clear that data bases do not create "information" of the kind that Beer was calling for. An argument might be made for numeric data bases that result from screening and enriching raw data. Conceivably, Beer was not thinking about the products of programs such as the National Standard Reference Data System and the international CODATA, whose function is to help create and disseminate useful scientific and technical data, whose existence can do much to reduce overlap and duplication of research as well as to expedite R&D. The operators of these programs could argue that basically Bear is right if he is referring only to raw, untested data.

Beer was undoubtedly unaware of what the Committee on Scientific and Technical Information (COSATI), Federal Council for Science and Technology, was doing in the scientific and technical information and data area a few years earlier than his talk. COSATI was very much concerned with the proliferation of data and data bases during the 1960s and the need to improve their management and use. It is not certain that

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Beer had scientific and technical information in mind when he pronounced his damnation of data in 1970. Data produced in economics, governance, commerce, and even census and other social fields may have been his bete noires. Nevertheless, a contractor, Science Communication, Inc., was asked to make a study of technical data in the United States. The president of that company, DeWitt O. Myatt, was considered to be expert in this field at that time. Beer would have been pleased to learn about the findings of Myatt's report. A summary of major conclusions concerning scientific and technical data perspectives and policy implications includes the following:

> The utility of our national scientific and technical (S&T) data resource can be substantially increased by improved management.
>
> No effective means to coordinate and integrate data management and data handling activities of the governmental, professional and industrial sectors of S&T currently exists.
>
> S&T data and data activities are exceedingly complex; national data programs and systems development efforts must recognize and accommodate this complexity.
>
> The full utility of S&T data is not currently realized under existing data management and data handling policies.
>
> Knowledge is inadequate concerning the nature (quantity, quality, location, ownership, usefulness, etc.) of existing S&T data to permit the optimum design of national data management programs or data handling systems.
>
> Federal policy re S&T data management must recognize and facilitate maximum use of the existing S&T data resource. As data handling becomes increasingly automated, data standardization will become increasingly important to the National S&T Data Program.
>
> The diverse connotations assigned by different communities, organizations, and individuals to S&T data, data artifacts, and data management and handling efforts constitute severe barriers to systematic planning and evaluation. As science is international, S&T data activity is often international in scope.

To make inroads on the problem, Myatt recommended that the Executive Office of the President should issue a policy statement establishing the objectives of a national program to improve the management of S&T data activities within government, the professions, and industry. It should also establish a National Advisory Council for

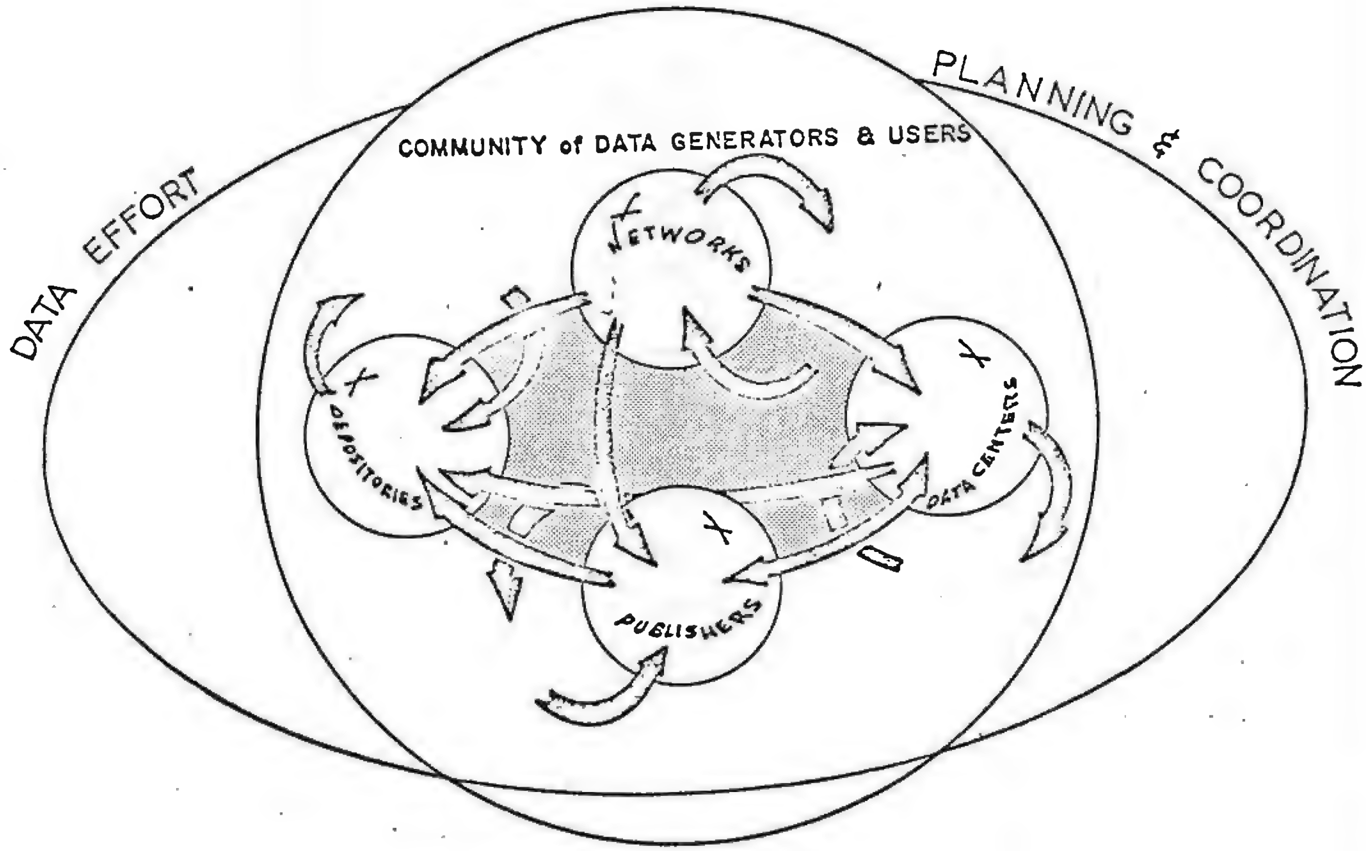
[1] Myatt, DeWitt O., Study of Scientific and Technical Data Activities in the United States, Presentation to COSATI Task Group on National Systems, June 26, 1968, Contract F44620-67-C-0022, Office of Aerospace Research, Washington, D.C.pp 31.

S&T Data. Additionally, a National Index of S&T Data should be developed, if data management is to be planned on a systematic basis. There were a number of other recommendations calling on COSATI and other groups in an out of the government involved in the generation or use of S&T data to take certain actions of a coordinated nature.

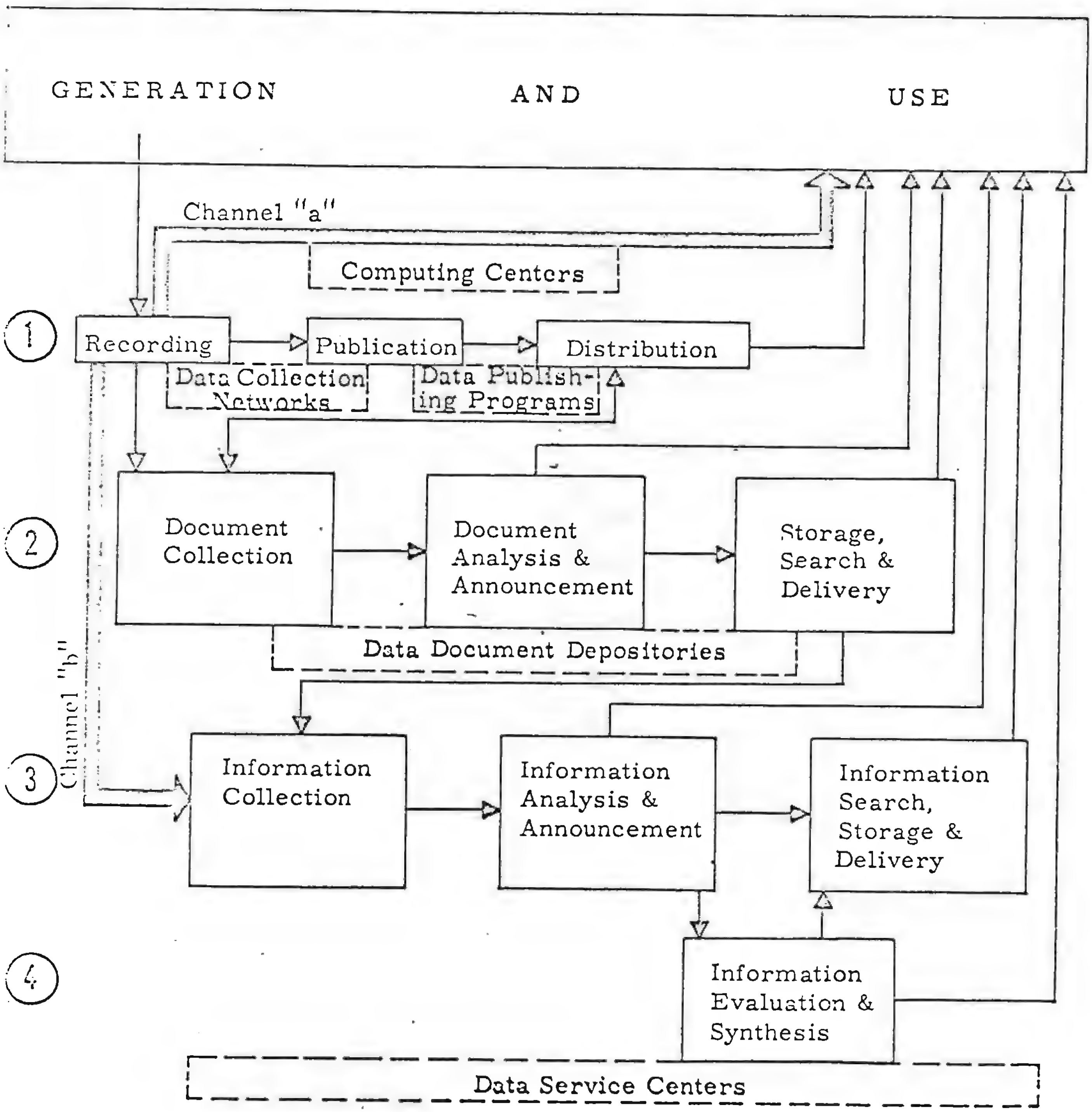
This brief account of the Wyatt Study hardly does justice to the careful thought that went into it. Suffice it to say that COSATI recognized the need for a strong effort to bring order to Federal and other S&T data programs to obtain the fullest benefits from the large investments that produced the data. Additional comments about the subject will be found in the discussion of the COSATI era.Three diagrams are reproduced on the following pages that demonstrate the depth of the thinking that went into the Wyatt Study.

It would be pleasant to state that the Wyatt Study was widely read and its influence pervasive in succeeding years. The fact of the matter is that its contents were probably not known outside of the COSATI members who were present when the meeting took place. It must ruefully admitted that even if the findings and recommendations were broadcast widely, little would probably have happened. One reason for this plagues the information community today, the extreme compartmentalization of data programs almost amounting to compete insulation one from another. Oceanographers, census experts, health officials, chemists and chemical engineers, geoscientists, behavioral and social scientists, and environmental scientists, to name but a few, are interested almost exclusively in information and data in their own fields. The notion of working together to coordinate the total US. data program remains an alien idea, hence, data systems in these fields/ continue to be developed by scientists and others only to serve their individual communities. Absent a demand on the part of the tenders of individual S&T data systems calling for a Federal or a national approach, it would be a 'hard rock' impossibility to push in the direction that the Myatt Study recommends. Absent a consensus among S&T leaders in the government to push hard for an integrated S&T data system, the possibilities are watered down even more. Recog-

SCHEMATIC OF FUNCTIONAL DATA EFFORTS SERVING A DEFINED COMMUNITY OF SCIENTIFIC AND TECHNICAL ACTIVITY

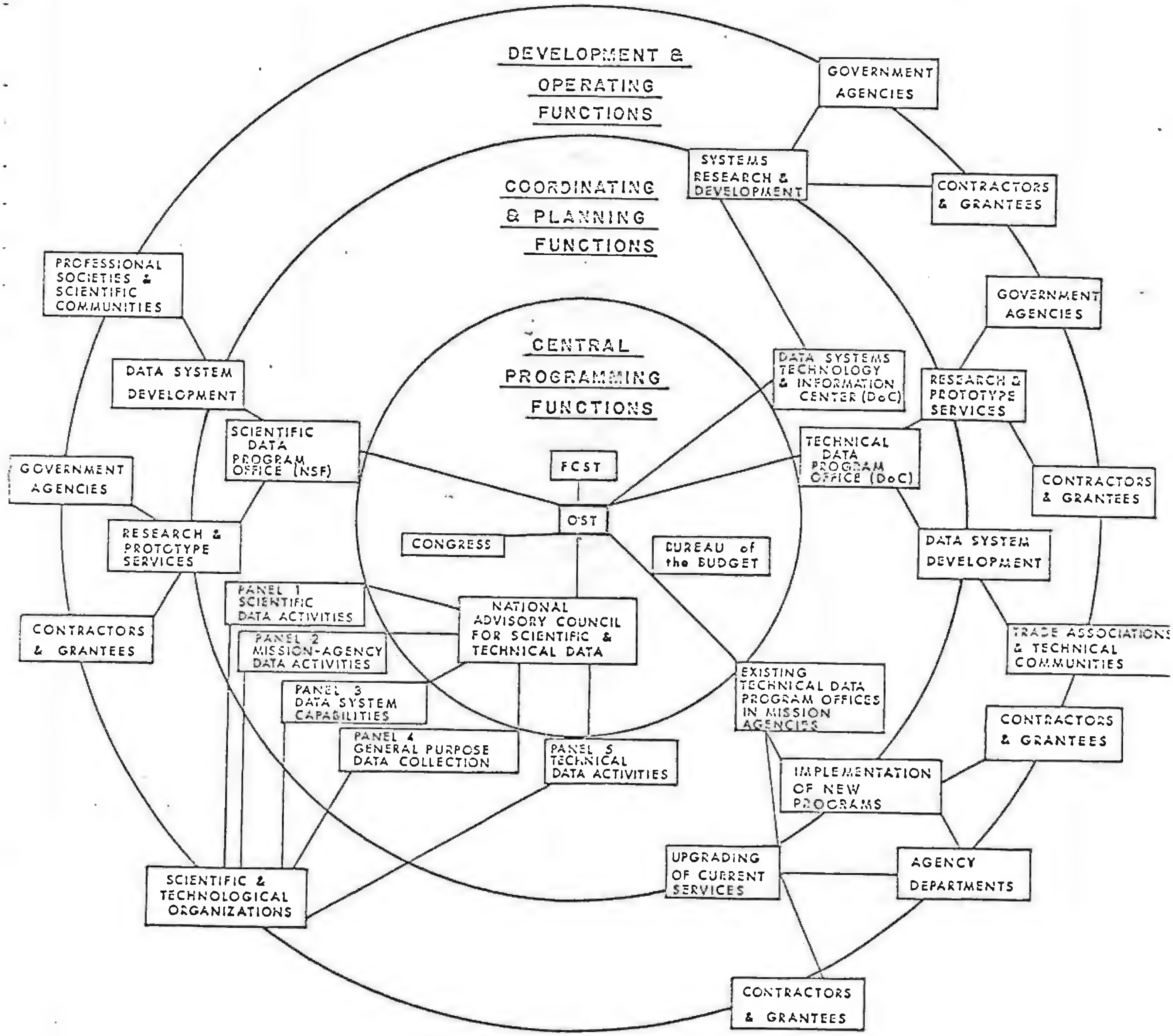


DATA FLOW AND PROCESSING SUPERIMPOSED ON CLASSICAL INFORMATION FLOW



Science Communication
Washington, D. C. 200 07
Contract F44620-67-C-0022
26 June 1968

PRINCIPAL ORGANIZATIONAL AND PROGRAMMATIC ELEMENTS OF THE NATIONAL SCIENTIFIC AND TECHNICAL DATA PROGRAM



nition of the benefits that would derive from a more organized and planned approach to handle S&T data will probably grow as information resource management needs take stronger root in the future.

Returning to information and data bases, perhaps the time has come to differentiate and call them information bases and data bases, depending on their content, there is no reason to believe that they will not continue to proliferate, branch and reproduce in the future. Certainly, they offer information professionals and an increasing community of users, a valuable way to sift through the mountains of information and data that contain what they are seeking, even if full text is not yet available in most of these information banks. Inevitably, there will be a movement to provide high quality information base services to reduce the amount of time that users must take to ferret out their needs. It is reasonable to expect that they will be willing to pay a premium for such enriched information.

Insofar as the development of information services that recognize the need to reduce complexity is concerned, this too will be an area that will receive considerable attention in the future. The thrust for these services will come from problem-solvers and crisis managers, legislators and others who are served by a diversity of information sources that have each grown independent of one another. Some stimulation will come from the vendors of information and data bases in the commercial sector, who recognize the need for standardization and data base transparency to make their information wares more useful and marketable.

Finally, there still remains a strong probability that future Presidents and their staffs - many of whom will come from the knowledge industries in the future - will recognize the need for government leadership in this area. Certainly, the information systems that serve the Federal government would be enriched if more rationalization and planning was required. Like Stafford Beer said, "Society has become a complex system and it needs a nervous system. Managing the development of information science and technology is all about this task. There is no other message than this."

SUMMARY

The two big events that propelled the United States into science and technology resulted from the research and development programs of the Department of Defense and the National Aeronautical and Space Administration during and after World War II. The Department of Defense harnessed the talents of American scientists and engineers to contribute to victory. The spark that illuminated the space program came from the success of the Russian Sputnik program and the development of a superlative team of scientists, engineers and "bureaucrats." Their success, more than any other factor, launched the United States into "Big Science." The lavish use of public funds galvanized action in several science and technology fields and the United States was on its way to become the leader in almost all of them. Grumblings about a technology gap and a brain drain came from all countries that found themselves behind the United States in the international sweepstakes. One product of all of these programs was scientific and technical information, vast quantitites that taxed the science information conduits established largely by learned scientific societies. Federal agencies were so busy'doing'R&D during the 1950s and early 1960s that they paid little attention to the need for highly organized and efficient information centers to gather, store, and disseminate STI internally and externally. It was evident that new ways and organizations were needed to sift the quality information and data from the mountains of information resulting from Federal, national and international R&D programs.

There was also concern expressed in Congress by Senator Hubert H. Humphrey and his colleagues that the prospects for duplication and overlap of R&D were high, if the Federal agencies did not better organize their infant information programs. The fortuitous arrival of new information technology made it possible to handle the proliferating file of technical knowledge more easily,offering the besieged research librarians a new and valuable tool, and stimulating the growth of the STI specialist and information scientist, who began to create data bases and networks to enhance interchange of large data banks over long distances. As the Federal agencies began to improve their programs, the professional societies began to do the same with the help

help of the National Science Foundation and other Federal agencies. Millions of taxpayers' dollars were provided these societies to computerize and "sophisticate" their information programs. The persistence of Senator Humphrey carried the day and the Federal R&D agencies made many improvements to strengthen their STI programs. The need for coordination of these programs become an issue, which was solved by the action of the Science Advisor to the President, Dr. Donald Hornig. First, he strengthened the capability of his own office in this area by selecting an information expert from industry, William T.Knox to head the STI program in his Office of Science and Technology. Second, he used the Federal Council for Science and Technology which he chaired to organize the Committee on Science Information which became the Committee on Scientific and Technical Information a year later. William T. Knox chaired COSATI during its early days. Third, he asked the President's Science Advisory Committee to undertake studies to determine what future actions were needed to further strengthen Federal and national STI programs. Through PSAC, COSATI and other Federal and non-Federal efforts, a series of studies, discussed in this chapter, were undertaken.

The emergence of the Federal programs in the STI field,added to the series of reports resulting from the studies, caught the attention of other countries and international organizations. Suddenly, information programs and information resources took on added importance as a lever of power and one of the tools being used by the advanced countries to consolidate and strengthen their status. More of the outlines of the Information Age were becoming visible. The National Science Foundation was given the responsibility to establish a program by legislation to serve the needs of all scientists. The three "national" libraries were stimulated to expand and improve their programs. In particular, the Library of Congress and the National Library of Medicine played a pioneering role whose momentum still continues to bring progress. A number of commissions and advisory groups were brought into being by Congress to cope with new needs brought on by the inroads of new information technology and the information "explosion." The legal system that was in place to meet the needs of less sophisticated information technology and practices showed obvious signs denoting chonge.

The emergence of a new information industry, centered in the private sector, was a lively development, providing new and old information products and services that featured the use of new information technology. International organizations, such as the United Nations and its family of specialized bodies, moved into the field by providing information products wanted by all countries and assisting developing countries to improve their information programs and practices.

So rapid was the growth that a movement started to seek ways to formulate national information policy in hopes of promoting orderly,harmonious progress. A few countries came up with long range national plans. An effort started by the Ford Administration to move into the formulation of national policy came to an end when his Administration drew to a close. During the late 1970s, it was apparent that marketplace forces were in the driver's seat and the notion of planning for the future - the belief that a national communication and information system might somehow be created by considering needs and the contributions new information technology could make - was not in the cards. The Carter Administration gave the proposal short shrift. The anti-regulation views of the Reagan Administration openly favored the free play of market forces and the shrinkage of the Federal government. In this kind of a climate, the break-up of the Bell System was accepted as perfectly natural. The effort to turn weather and LANDSAT satellites over to the private sector was in keeping with Reagan philosophy. The embargo-ing of unclassified scientific and technical information generated by Federally-supported R&D - another decision of the Executive Office of the President - was yet another sign that piecemeal information policies, piecemeal in the sense that other important considerations were rejected or minimized, were preferred over an integrated set of plans, policies and actions involving information and communication.

During the quarter of a century since World War II, the interest of scientists and some engineers in the evolution of scientific and technical information systems has waxed and waned. In consideration of their numbers, which swelled appreciably during the period, only a handful of scientsts have shown any interest in science communi-

cations. In the government, due to the involvement of the Science Advisor to the President and the committees that he chaired, there was an early interest in STI matters and progress. In subsequent years, this interest diminished and disappeared. In professional societies, information experts, for the most part, were employed to help upgrade discipline-based information programs.In the main, the effort embraced
publications for a
actions to provide/larger numbers of scientists to publish their studies. The computerization of their programs to cope with the prolieration of papers was undertaken with the help of the National Science Foundation and other agencies. "Page charge" subsidies that help the professional societies cope with economic problems are still being provided by the Federal agencies. Some professional societies have created data bases and have either created networks to make information available or have rented their data bases to commercial vendors to do so. The rank and file scientist, however, seems to have remained aloof from direct participation of the upgrading process, although there are some signs that he or she is increasing the use of computerized data bases. Concern seems to be more with having a publication in which he can publish and having membership in "invisible colleges" of trusted colleagues. Few scientists of national reputation have shown interest in the massive "institutionalization" of science communication processes going on during the last couple of decades. Intermittently, organizations such as the National Academies of Science and Engineering and the American Association for the Advancement of Science become interested in STI, but hardly more. Moreover, knowledge of the seminal reports dealing with Federal and national STI, turned out by Federal and non-Federal sources, is unknown to most scientists and engineers in the United States. The apparent insensitivity of the science community to science communications in an Information Age may have a long term impact that may inhibit the creativity and productivity of national and Federal research and development, as well as the vigorous utilization of the world's scientific and technical knowledge. The current "leaders" of the U.S. science and technology estate need to be held to account for their failures to play a more aggressive role in harnessing STI and information techniques to national needs.

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The last quarter of the century has been a period that is momentous in many ways. One of these is the explosive growth of technical and other information data bases and interactive networks that provide conduits to a growing number of users. This growth in no immediate way has challenged the pre-eminancy of the printed word in the book, the magazine, and other ink-print carriers of knowledge, but in the next decade the inroads will be obvious. The marriage of computers and communications and the arrival of satellites, crowned by other new information technologies, are changing the way information is gathered, stored, retrieved and disseminated. The expansion of users,many of them home-based, will assure the creators and disseminators a market for the new data bases. The downward spiral of the costs of small computers and the rapid education and training of an increasing percentage of the U.S. population in the use of computers and data bases will accelerate the process.

In the next decade, it is probable that strong steps will be taken by the producers and distributors of the scientific and technical data bases to provide "screened and enriched" information products to their clients. Information analysis centers, the institutions that are led by accredited scientists who are assisted by information experts, will play an increased role in identifying the higher quality information and data in the information systems. Both the government and the private information sectors are expected to play vigorous and cooperative roles in the decade ahead to perfect Federal and national science communications. Learning how to work together in the national interest is now the order of the day.